Digitized by the Internet Archive
in 2015

https://archive.org/details/louisianabulleti4404loui

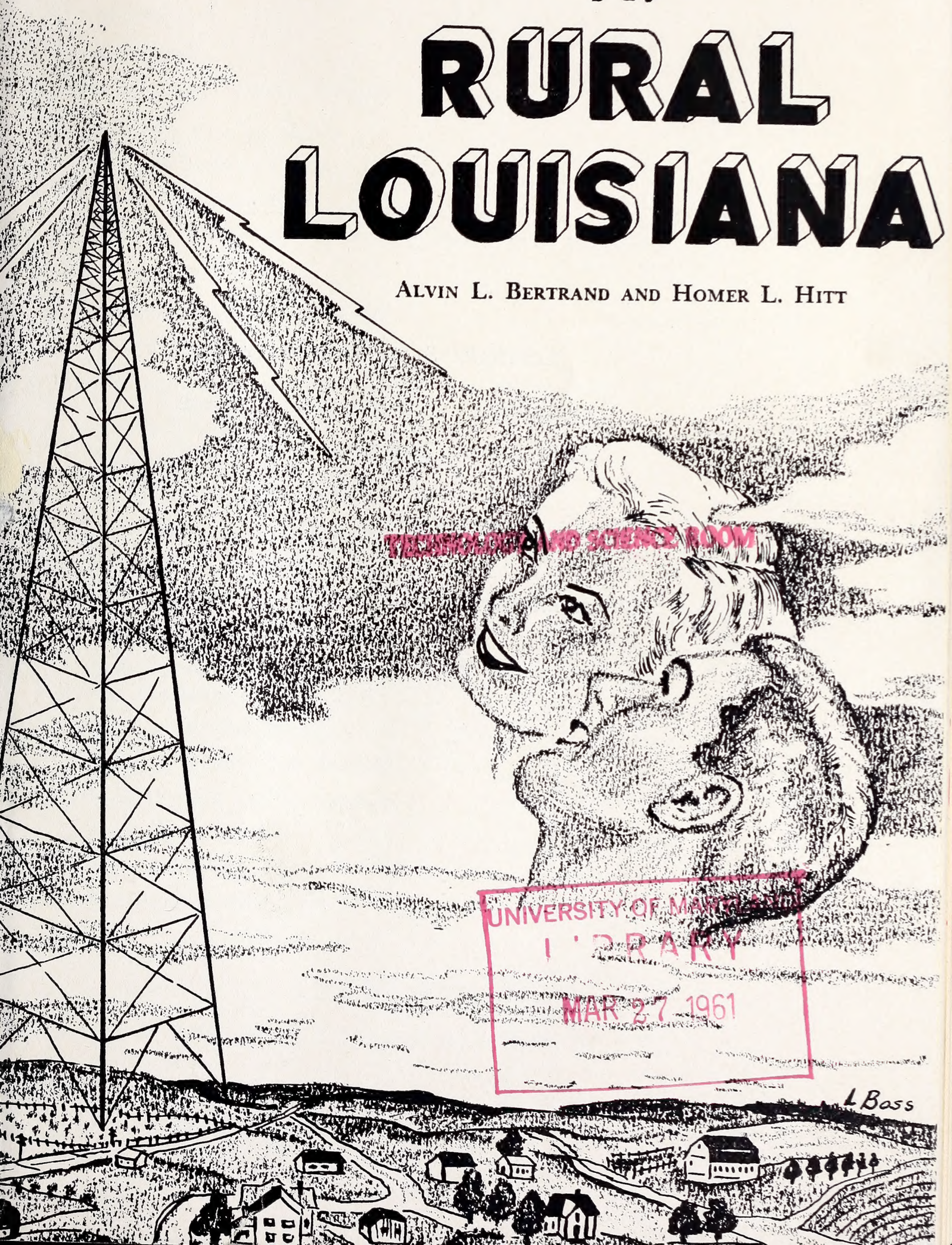
ISIANA BULLETIN NO. 440

SEPTEMBER 1949

L93b
2d Set
202

RADIO HABITS IN RURAL LOUISIANA

ALVIN L. BERTRAND AND HOMER L. HITT



TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
LIBRARY
MAR 27 1961

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

IN COOPERATION
WITH
LOUISIANA AGRICULTURAL EXTENSION SERVICE

TABLE OF CONTENTS

PAGE

PREFACE 7

I. SUMMARY 9

II. INTRODUCTION 10

Objectives 11

Methodology 12

III. TYPICAL RADIO LISTENING PATTERNS 13

Week-day Listening Habits 15

Saturday Listening Habits 18

Sunday Listening Habits 20

Time Preferences for Winter and Summer Farm Broadcasts 23

IV. RADIO PROGRAM PREFERENCES 24

General Categories of Programs 24

Specific Types of Programs 29

V. PREFERENCES CONCERNING OTHER ASPECTS OF RADIO PROGRAMS 37

Length of Farm Programs 37

Number of Persons on Farm Broadcasts 38

Broadcasts from the Farm 39

Experiences in Taking Down Recipes and Formulas 41

Programs in the French Language 42

Ownership of and Intentions to Acquire FM-Equipped Radios 43

Source of Local News 44

VI. SUBJECTS FARMERS AND RURAL HOMEMAKERS WANT DISCUSSED ON FUTURE BROADCASTS 46

Homemaking and Health 47

Livestock, Poultry, and Dairying 49

Farm Practices and Management 49

Crops 50

Home Gardening 50

Miscellaneous Information 51

LIST OF TABLES

I. Persons Interviewed in the Four Sample Areas, by Sex and Race, Louisiana, 1948 14

II. Proportions of Farm Radio Audience Expressing Preferences for Specified Subjects on Future Farm Broadcasts, Four Farm Survey Areas, Louisiana, 1948 . 48

LIST OF FIGURES

FIGURE PAGE

1. Map of Louisiana Showing the Location of the Four Farm Survey Areas, 1948 12

2. Proportions of Farmers Interviewed Who Reported Listening Regularly to their Radios at Specified Times on Week-days, Four Farm Survey Areas, Louisiana, 1948 16

3. Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Week-days, Four Farm Survey Areas, Louisiana, 1948 17

4. Proportions of Farmers Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Saturdays, Four Farm Survey Areas, Louisiana, 1948 19

5. Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Saturdays, Four Farm Survey Areas, Louisiana, 1948 20

6. Proportions of Farmers Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Sundays, Four Farm Survey Areas, Louisiana, 1948 21

7. Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Sundays, Four Farm Survey Areas, Louisiana, 1948 22

8. Number of Persons Expressing Preferences for Specific Times for Summer and Winter Farm Broadcasts, by Sex, Total Sample of Four Farm Survey Areas, Louisiana, 1948 23

9. Proportions of the Farm Radio Audience Expressing Preferences for General Categories of Day Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948 26

10. Proportions of the Farm Radio Audience Expressing Preferences for General Categories of Night Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948 28

11. Proportions of the Farm Radio Audience Expressing Preferences for Specific Types of Music Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948. 30

12. Proportions of the Farm Radio Audience Expressing Specified Degrees of Interest in Broadcasts of Market Reports, by Sex, Four Farm Survey Areas, Louisiana, 1948 32

13. Proportions of the Farm Radio Audience Expressing Specified Degrees of Interest in Broadcasts of Weather Reports, by Sex, Four Farm Survey Areas, Louisiana, 1948 34

FIGURE

PAGE

14. Proportions of the Farm Radio Audience Reporting Specified Patterns of Listening Regularity to County and Home Demonstration Agent's Broadcasts, by Sex, Four Farm Survey Areas, Louisiana, 1948 35

15. Proportions of Farm Radio Audience Reporting Specified Reasons for not Listening to Broadcasts by County and Home Demonstration Agents, by Sex, Four Farm Survey Areas, Louisiana, 1948 36

16. Proportions of Farm Radio Audience Expressing Preferences for Particular Lengths of Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948 38

17. Proportions of Farm Radio Audience Expressing Preferences Concerning Number of Persons on Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948 39

18. Proportions of Farm Radio Audience Expressing Preferences Concerning Points of Origin of Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948 40

19. Proportions of Farm Radio Audience Reporting Difficulty in Recording Recipes and Formulas, by Sex, Four Farm Survey Areas, Louisiana, 1948 41

20. Proportions of the Farm Radio Audience Expressing Preferences for French and English Broadcasts, by Sex, Four Farm Survey Areas, Louisiana, 1948 ... 42

21. Proportions of Farm Radio Audience Owning FM-Equipped Radios, by Sex, Four Farm Survey Areas, Louisiana, 1948 44

22. Proportions of the Farm Radio Audience Expressing Intentions Concerning the Acquisition of FM-Equipped Radios, by Sex, Four Farm Survey Areas, Louisiana, 1948 45

23. Proportions of the Farm Radio Audience Possessing Specified Sources of Local News, by Sex, Four Farm Survey Areas, Louisiana, 1948 46

24. Proportions of Farm Radio Audience Expressing Preferences for Specified Subjects on Future Farm Broadcasts, Four Farm Survey Areas, Louisiana, 1948 47

Preface

This survey, made at the request of and in cooperation with the Louisiana Agricultural Extension Service, analyzes the radio listening patterns and program preferences of farm people in Louisiana. It is an attempt to bring together, in a systematic and meaningful form, factual data which will be of use to persons interested in reaching the rural-farm groups through the medium of the radio.

It is envisioned that the information presented will prove valuable, not only to the County and Home Demonstration Agent, but to many others as well. Indeed, if agricultural program planning for radio is materially influenced by these findings, Louisiana farm people themselves stand to benefit most in the long run. If form and content of programs are adapted to their tastes and their expressed needs, farm people will not only get the type of farm and home information that they want, but they will hear it presented at a time most convenient to them and in a manner most pleasing to them.

The information gathered in this study is discussed under four broad headings or parts. The first deals with the typical radio listening patterns of Louisiana farm people. This part presents the most popular listening periods during the day and night for week-days, Saturdays, and Sundays for adult farm men and adult farm women. The second part is concerned with the radio program preferences of rural-farm people in the state. This section gives consideration to both the preferences by general categories of programs and the preferences for specific types of programs. The third part of the study is devoted to the farm audiences' preferences concerning other aspects of radio programs, and treats such subjects as preferences concerning program length, the number of people on programs, programs in French, etc. The fourth and final part centers on the subjects farmers and homemakers would like to have discussed on future broadcasts.

The data were obtained by the field survey method. Trained enumerators took 1,268 schedules in four rural areas of the state. The schedule called for a considerable range of information. In presenting the data obtained from the schedule, graphic methods have been utilized almost entirely because of the facility with which patterns and relationships can be conveyed in this manner.

Many persons have contributed to the preparation of this report. Among these, special thanks are due Director W. G. Taggart of the Louisiana Agricultural Experiment Station and Director H. C. Sanders of the Louisiana Agricultural Extension Service, who, with keen insight into the field of radio as a means of reaching farmers, approved this study as one of the official projects of their respective divisions of the College of Agriculture. Mr. G. L. Burleson, Program Analyst, Louisiana Agricultural Extension Service, and Mr. G. J. Durbin, formerly Associate Editor (Radio), Agricultural Extension Service, originally brought this particular subject to the attention of the rural sociology staff and made indispensable contributions throughout the course of the study. The following graduate and former graduate students in the Department of Sociology at Louisiana State University assisted in the taking of schedules: Mr. W. F. Beyer, Jr., Mr. J. N. Burrus, Mr. T. R. Ford, Mr. A. S. Freedman, Mr. J. H. Jones, Jr., Mr. J. B. Mitchell, Mr. H. M. Trice, and Mr. R. O. Trout. Miss Louise Kemp, then Research Assistant in the Department of Rural Sociology, also made valuable contributions to the field investigations. In addition to patiently typing the manuscript, Mrs. Colleen Collier did much of the necessary tabulation and graphic work. Mr. John N. Burrus also helped with the graphic work and, along with Mr. Roland Pellegrin and Mr. C. W. Fogleman, contributed valuable editorial assistance. The cover was designed and executed by Miss Lorraine Boss. To these, and to all the others who have helped in any way with the report, the writers wish to express their sincere thanks.

ALVIN L. BERTRAND and
HOMER L. HITT

Radio Habits in Rural Louisiana

A Study of Listening Patterns and Program Preferences of the Farm Radio Audience in Selected Areas of Louisiana

ALVIN L. BERTRAND AND HOMER L. HITT

DEPARTMENT OF RURAL SOCIOLOGY
LOUISIANA AGRICULTURAL EXPERIMENT STATION

I. SUMMARY

1. Although the radio listening patterns of Louisiana farm people vary somewhat among the survey areas and between the sexes, they exhibit some interesting uniformities. On week-days a greater proportion of this audience listens to the radio regularly from 12:00 noon to 12:30 P. M. than at any other time. On Saturdays the most popular listening time is from 8:00 to 9:00 P. M. Sunday listening habits are quite different from those of all other days in that the audience does not build rapidly to definite peaks. Instead, there is a gradual increase in the proportion of persons listening until 8:00 A. M., and then a leveling off with minor changes until 7:00 P. M. From the latter hour there is a slight increase in the proportion of farm people listening until 9:00 P. M., after which time the size of the audience begins to decline.

2. The farm people of Louisiana have definite radio program preferences. As a whole, their favorite general category of a daytime program is news. Ranking in second place among their preferences are musical programs. At night they prefer music and comedy and variety programs. Despite variations among areas and between sexes, by far the most popular type of music is "western" and "hillbilly." Keen interest is manifested in market and weather reports, but interest in County or Home Agents' broadcasts, though substantial, is considerably less pronounced.

3. The rural audience has definite preferences concerning other aspects of a radio program. From their responses it is evident that they favor a 15-minute program in which two or more persons take part and which originates from the farm. Considerable numbers of them who had tried to take down a recipe or formula had had difficulty in doing so, a fact which may possibly indicate a need for more effective methods of presentation. The statements of informants in French Louisiana leave no doubt but that they have a preference for programs in French. Very few farmers own FM-equipped radios but, significantly, a considerable number expressed the intention to acquire such sets.

4. Subjects classifiable under the general topic of homemaking and health were mentioned proportionately most often as desired topics for future broadcasts. There were, however, many calls for information falling under the broad heading of livestock, poultry, and dairying; farm practices and management; crops; and home gardening.

II. INTRODUCTION

Over a decade ago it was observed that the radio was becoming an important factor in banishing the physical and cultural isolation of rural people.[1] Since that time technological improvements and mass production have made available radios in all price ranges. Long wave, short wave, and frequency modulation (FM) broadcasting have, in fact, reached practical maturity, and even television is now accessible to some rural areas.

The Broadcast Measurement Bureau has compiled statistics (the latest available) which indicate that 94.2 per cent of the families in the United States owned at least one radio in 1948.[2] The Bureau's estimate that 88.7 per cent of the rural-farm families in the United States and 76.5 per cent of those in Louisiana now own radios is more important to this study. In comparison, of the families questioned in the present study, 90.2 per cent reported that they owned radios. This apparently high proportion can probably be accounted for on the basis of the proximity of the areas surveyed to urban centers.

The above figures indicate that the radio, at present, can be used as a communication device which will reach virtually all of the rural population. Furthermore, it is well known that radio communication lends itself to the dissemination of information and the influencing of public opinion.[3] The importance of the radio during World War II in combating the enemy and promoting a united effort on the home front testifies to its importance in this respect.

Because of the very nature of their work, the Agricultural Experiment Station and the Agricultural Extension Service have a unique educational responsibility to farmers and homemakers. This obligation, in view of the above facts which point to the radio as an invaluable potential aid to rural education, makes it highly desirable that these agencies approach radio with the end in view of utilizing it in the most effective manner in their work with agrarian groups. The above does not imply that no such studies have been made. On the contrary, several excellent surveys have been concerned with the radio as a means of disseminating agricultural information.[4] The number of these studies, however, has been relatively small and their scope limited. Moreover, while it may be possible to use the findings of the above mentioned reports as general reference guides, regional and even intra-state differences make it imperative to have comprehensive information for more limited areas.

---

[1] Edmund deS. Brunner, *Radio and the Farmer*, New York: The Radio Institute of the Audible Arts, 1936, p. 11.

[2] *BMB Quarterly*, Broadcast Measurement Bureau, New York: Vol. I, No. 4, 1948, pp. 8-9.

[3] For a list of the different ways in which the radio may influence society, see: William F. Ogburn and Meyer F. Nimkoff, *Sociology*, New York: Houghton Mifflin Co., 1946, pp. 849-853.

The present study is an attempt to answer some of the questions which have arisen in connection with experiments in the transmission of agricultural information by radio in Louisiana. Since this is a pioneering study, it may raise as many questions as it answers. If it does, and if these additional questions lead to further investigation and research, a useful purpose will still have been served.

Objectives

The major objectives of this study are fourfold. In the first place, it was desired to obtain information relative to the times of day or night (evening) that farmers and rural homemakers[5] listen to the radio with greatest regularity. In this respect, knowledge was sought concerning differentials in listening patterns in summer and winter, and on weekdays, Saturdays, and Sundays. Such information, of course, can remove one of the great unknowns in the presentation of radio programs designed for an agricultural audience. Broadcasters who possess this information will know approximately what proportion of the given population would be listening at any particular time.

The second purpose was to discover which radio program or programs that farm people like best. Any particular audience makes certain choices in its program likes and dislikes, and is, thus, selective in its listening. With a knowledge of what farmers and homemakers appreciate and prefer, the farm broadcaster will be better able to attract and to hold his audience.

Next, it was proposed to find out what other aspects of radio programs appeal to the rural audience. In this connection it was felt that reliable information regarding the prevailing preferences with respect to length of the program, the method of presenting it, etc., would provide valuable information to the broadcaster.

The fourth and final purpose of the study was to determine what subjects farmers and homemakers are most interested in hearing discussed by county agricultural agents and/or home demonstration agents. With information of this type available, it will be possible for extension workers and other agricultural specialists to prepare broadcasts dealing with items of major interest to farm groups and to plan programs that will render the greatest service to the community.

---

[4] For a summary of recent Agricultural Extension radio surveys, see: Gladys Gallup, *Radio as a Source of Agricultural and Homemaking Information*, U. S. Agricultural Extension Service Circular No. 453, U. S. Department of Agriculture, Washington: June, 1948.

[5] A farm wife or an adult woman of a farm household.

Methodology

A number of factors contributed to the final decision concerning the procedures to be followed in this study. In the first place, the wish of the Agricultural Extension Service to employ this study as a means of checking and evaluating the results of their past endeavors in radio broadcasting, limited the farm areas to be enumerated to sections within range of certain low-power local stations which had been used. Furthermore, it was deemed feasible to sample to some extent every major type-of-farming and cultural area within the state. To satisfy these requirements, it was decided to survey areas within a 35-mile radius of certain strategically located (with respect to type-of-farming and culture areas) cities. Four such circular areas were selected, one centering in each of the following cities: Baton Rouge, Ruston, Alexandria, and Crowley. See Figure 1.

Next, the problem of obtaining the desired information on radio listening from farm women as well as from men, and from Negroes as

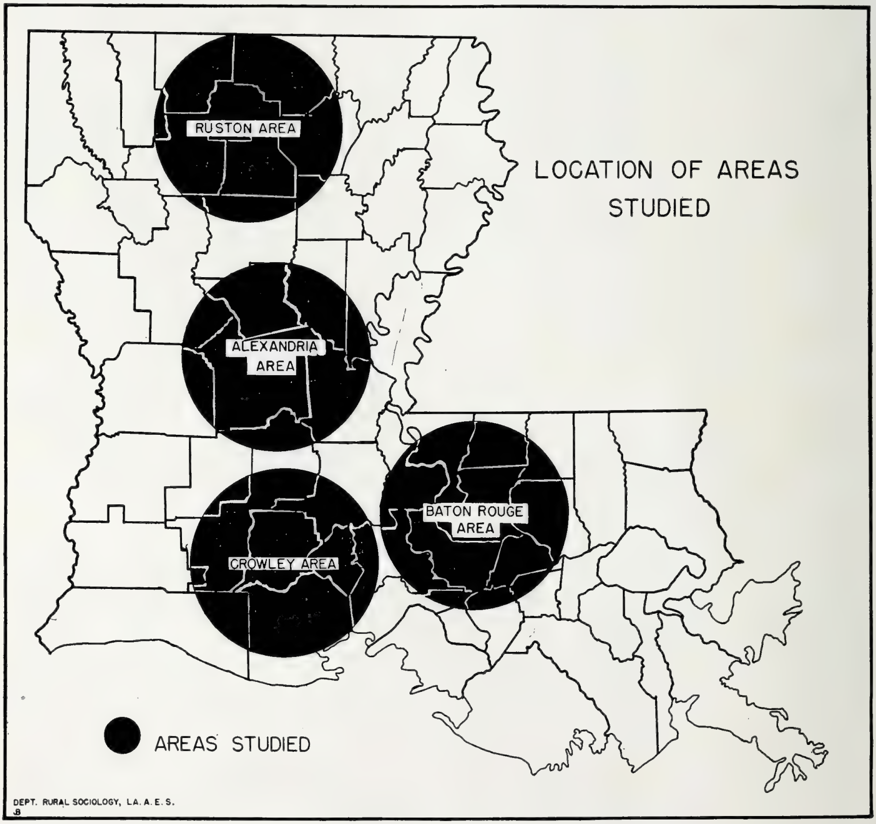


FIGURE 1.—Map of Louisiana Showing the Location of the Four Farm Survey Areas, 1948.

well as from whites, from the several tenure groups, and for farms of various sizes had to be reckoned with. The aim here was primarily to obtain a representative sample rather than to assemble sufficient information for a detailed comparative analysis of the multifarious component elements. Furthermore, the survey had to be accomplished with limited funds. In view of these considerations and realities, it was decided to have a controlled sample within each area. Accordingly, each area was divided into quarters, and these quarters were subdivided into blocks three miles square. The blocks within each quarter were then numbered consecutively. Tippett's random sampling numbers were used to select certain blocks (six in each quarter) for complete enumeration.[6] It was felt that the sample thus obtained would be satisfactory for the purposes of this study. As can be seen in Table I, a total of 1,268 schedules was obtained. Of these, 976 were taken among whites (including 450 men and 526 women), and 292 were taken among Negroes (including 145 men and 147 women). It may be noted that while 1,268 schedules were completed, only 1,069 homes were represented. This discrepancy is accounted for by the fact that the farmer and his wife were both interviewed whenever possible.

The information recorded on the schedules was sorted and tabulated in the conventional manner. The analysis is simple and straightforward, with comparisons by sex and area emphasized. Because it has been found that tabular data when converted into graphs and charts tell a story more quickly and more effectively, and because such illustrations facilitate the presentation of facts for comparative purposes, most of the findings are presented in graphic form.

III. TYPICAL RADIO LISTENING PATTERNS

Radio station operators and radio advertisers have long been aware that there are certain peak listening periods each day. This is evidenced by the fact that certain "spots" sell at premium prices and are much sought after by radio performers as well as sponsors. The farm radio audience also is characterized by listening habits that favor specific times and programs. During certain periods of every day, farm people find it more convenient and more desirable to listen to the radio. It follows, therefore, that the farm broadcaster will be able to do a more effective job with such information at his disposal. Provided optional opportunities are available, he will be in a better position to accomplish his purposes even though he is obliged to depend upon time donated by the radio stations to "public service."

The reader is probably aware of the fact that a "typical radio day" is, strictly speaking, a fictional representation. Each day, each week, and each season have individual variations such as weather conditions, special

---

[6] L.H.C. Tippett, *Tracts for Computers*, No. XV, London: Cambridge University Press, 1927.

TABLE 1. PERSONS INTERVIEWED IN THE FOUR SAMPLE AREAS, BY SEX AND RACE, LOUISIANA, 1948

AREA	SCHEDULES COMPLETED																	
	TOTAL						WHITE						NEGRO					
	Total		Males		Females		Total		Males		Females		Total		Males		Females	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Baton Rouge	320	25.2	156	26.2	164	24.4	191	19.6	91	20.2	100	19.0	129	44.2	65	44.8	64	43.5
Ruston	309	24.4	137	23.0	172	25.5	225	23.1	96	21.3	129	24.5	84	28.8	41	28.3	43	29.3
Alexandria	283	22.3	135	22.7	148	22.0	229	23.4	108	24.0	121	23.0	54	18.5	27	18.6	27	18.4
Crowley	356	28.1	167	28.1	189	28.1	331	33.9	155	34.5	176	33.5	25	8.5	12	8.3	13	8.8
Total	1,268	100.0	595	100.0	673	100.0	976	100.0	450	100.0	526	100.0	292	100.0	145	100.0	147	100.0

events, and competing attractions which modify listening patterns. However, the slight variations in program schedules which occur from time to time as a result of changes to daylight saving time or the superimposing of sports presentations and special events programs on the normal schedules do not have any appreciable effect on the long-time listening patterns of the people. Therefore, it seems safe to conclude that valid and reliable conclusions can be drawn from the responses of the hundreds of farm people interviewed concerning the time of day or evening they regularly listen to their radios.

The information pertaining to the above facts is presented by individual areas. This will make it possible for persons from the various sections of the state not only to appraise their local situation in regard to radio listening patterns, but also to compare it with that of the farm population in other parts of the state. The data for men and women are presented separately because of significant differences in their listening habits.

Each rural-farm man or woman interviewed whose home was equipped with a radio was asked to report the times at which he or she listened to the radio regularly during the week, on Saturday, and on Sunday. Their responses were recorded by quarter-hour periods (to coincide with customary program schedules) and graphed. Percentages were computed only on the basis of the total number of farmers or farm wives owning radio sets in each area, and comparisons and analyses were made accordingly. On the charts each quarter-hour period is connected to the one following it by a continuous line to form a listening curve.

Week-day Listening Habits

The fact is well known that the farmer and his wife are busy people. Consequently, the time when they can and do listen to the radio is rather limited. Just how limited it is may be seen in Figures 2 and 3, which indicate week-day listening patterns as determined from interviewee responses to questions regarding regular listening habits.

The Week-day Listening Patterns of Farmers. Taken as a whole, greater proportions of farmers listen to the radio from 12:00 noon to 1:00 P. M. and from 7:00 to 9:00 P. M. than at any other times. It may come as a surprise to some persons that the period from 6:00 to 8:00 A. M. ranks a relatively poor third among farmers' listening preferences. Such is the case, however, and despite some variations among the four areas studied, the above patterns are clearly evident in every instance. The programs scheduled between 6:00 and 7:00 P. M., and 9:00 and 10:00 P. M. reach approximately one-third of the adult male farm audience. The programs during these listening periods attract approximately the same proportions of listeners and are tied for fourth place among farmers' preferences.

The farmers' listening curve also definitely shows what times they are less apt to be listening to the radio. Among the programs least likely

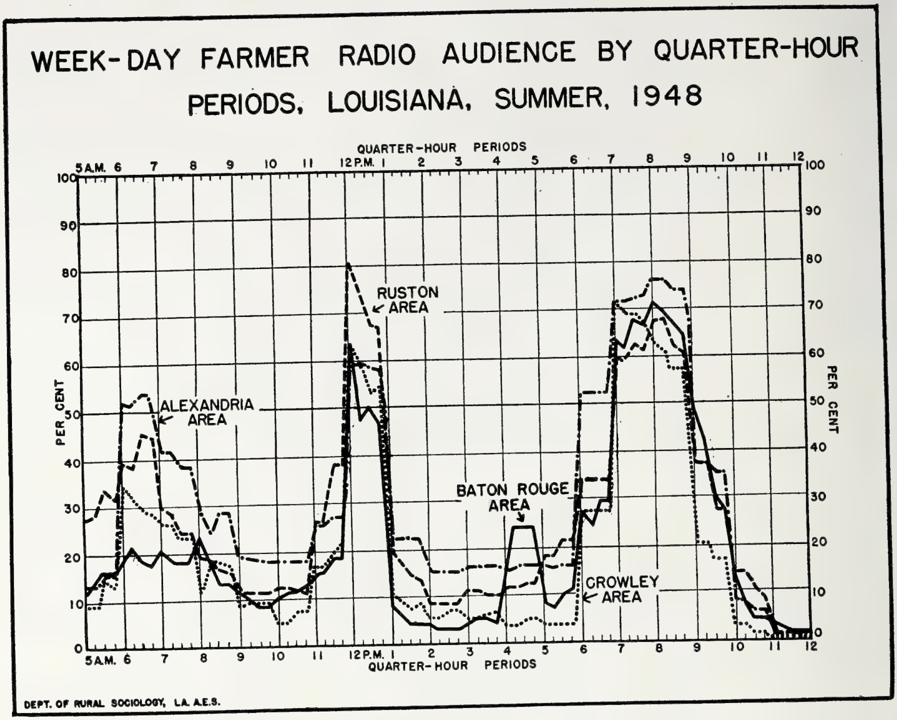


Figure 2.—Proportions of Farmers Interviewed who Reported Listening Regularly to Their Radios at Specified Times on Week-days, Four Farm Survey Areas, Louisiana, 1948.

to be heard are those broadcast during the periods from 8:00 a. m. to 12:00 noon, from 1:00 to 6:00 p. m., and from 10:00 p. m. to 12:00 midnight.

Several area differences in the week-day listening curves of farmers may be observed in Figure 2. Greater percentages of the Ruston area group listen to their radios in the very early morning (from 5:00 to 5:45 a. m.) and during the noon hour (from 12:00 to 12:45 p. m.) than of the other groups. Proportionately more farmers of the Alexandria area, in contrast, seem to devote time to radio listening during the morning, afternoon, and evening hours. In the Baton Rouge area only one period stands out in comparison with the other areas—the period from 4:15 to 4:45 p. m. This peak listening period is probably accounted for by the fact that the part-time farmers working in local industries change shifts about this time.

The Week-day Listening Patterns of Farm Wives. The old saying that "the woman's place is in the home" would lead one to believe that women have more opportunity to listen to the radio than men have. That rural women actually do spend more time than rural men listening to the radio is attested to by the data presented in Figure 3. Home dem-

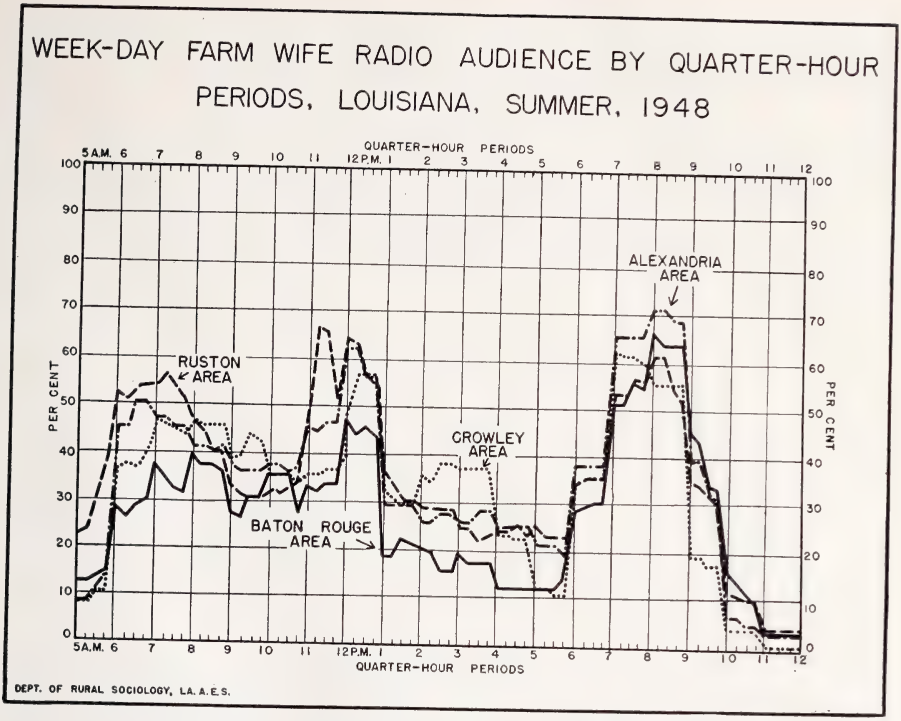


FIGURE 3.—Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Week-days, Four Farm Survey Areas, Louisiana, 1948.

onstration agents interested in reaching farm wives by radio on week-days may profit from the study of this chart.

The peak audiences, as in the case of farmers, exist during the periods from 12:00 noon to 1:00 P. M. and from 7:00 to 9:00 P. M. It should be pointed out, however, that the latter time will reach a somewhat greater proportion of the farm women. Of great significance is the fact that almost any hour of the morning after 6:00 A. M. will find over one-third of the farm wives with their radios turned on. It is also important that on week-day afternoons from 1:00 to 7:00 P. M. approximately one-fourth of the rural adult females are listening to their radios. In fact, except for during the comparatively short periods from 5:00 to 6:00 A. M. and from 10:00 P. M. to 12:00 midnight, a substantial proportion of the farm women are giving some attention to their radios.

According to these data, it would seem that the rural homemakers in the Ruston area arise earlier than the farm women in the other areas. At any rate, more of them report that they listen to their radios in the very early morning (from 5:00 to 6:00 A. M.). It is also obvious that this group of women makes a special effort to hear a program broadcast from 11:15 to 11:30 A. M. Over two-thirds of those in possession of radios report that they regularly listen to their sets at this time.

Another differential among the areas is noted with respect to the farm women residing in the vicinity of Baton Rouge. The comparative listening curves show that those homemakers who own radios in this area do not listen to them as much during the morning and afternoon hours as do the women in the other three areas. The listening curve for the women of the Crowley area is marked by the high proportion of homemakers who give attention to their radios during the period from 2:00 to 3:45 P. M. The Alexandria area women, on the other hand, listen regularly to their radios in greater relative numbers in the evening from 7:00 to 8:45 P. M.

Saturday Listening Habits

Saturday, among rural people, is a day which stands out. Not only is it the last week day before the "Day of Rest," but it is also the day of "going to town," of shopping, and of recreation. Such activities necessitate a shift from the week-day routine and could conceivably change radio listening patterns. For this reason all informants were asked at what time or times they listened to the radio regularly on Saturday. The responses given by farmers and their wives are shown, in graphic form, in Figures 4 and 5.

The Saturday Listening Patterns of Farmers. In general, farmers listen to the radio more on Saturday than on week-days. Saturday evening, as might be expected, is a very popular listening time. Considered as a group, at least 70 per cent of the interviewed males are listening to the radio from 7:00 to 10:00 P. M. Between 8:00 and 9:00 P. M. the listening curve for Saturday reaches its peak, with almost 80 per cent of the farmers listening regularly at this time. The curves in Figure 4 also show that proportionately more of this group listen to the radio during the late hours of the night on Saturday than on week-days. Interestingly enough, approximately one-tenth of all farmers with radios are listening to them at midnight on Saturday.

Similar to week-days, on Saturday the noon hour is a popular listening time for farmers. However, smaller proportions of them listen at this time than during the week. The fact that many farmers are already in town and others are in the process of preparing to go there probably accounts for this phenomenon. The third largest Saturday radio audience among farmers is in the early morning from 6:00 to 8:00 A. M. An interesting observation is that greater proportions of farmers listen regularly to the radio during all hours of the morning and afternoon on this day than on week-days.

Area differences in listening are not as pronounced on Saturday as they are during the week for farm men. One fact stands out, however: the farmers in the Alexandria area with few exceptions listen to the radio regularly in greater numbers on Saturday than do farmers from the other three areas.

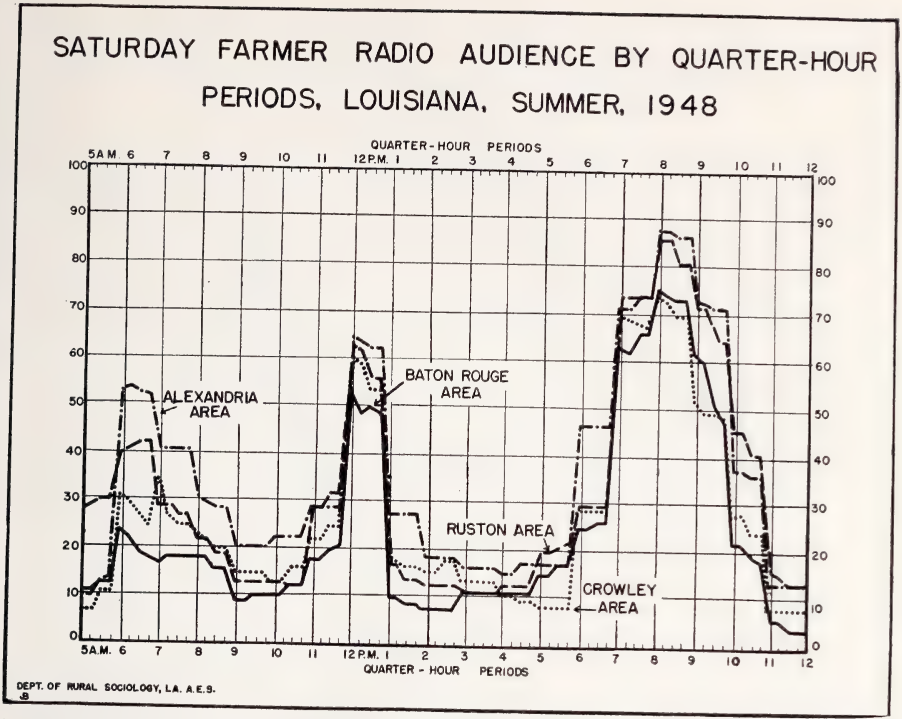


FIGURE 4.—Proportions of Farmers Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Saturdays, Four Farm Survey Areas, Louisiana, 1948.

The Saturday Listening Patterns of Farm Wives. Like their husbands, farm women listen to the radio more on Saturday than during the week. Also, as is the case with their husbands, their principal listening time is in the evening. Programs scheduled between 7:00 and 10:00 P. M. usually have an audience of at least three-fifths of these women, and those broadcasts from 8:00 to 9:00 P. M. may reach three-fourths of them. It is interesting to note that proportionately fewer women listen to the radio on Saturday morning than on week-day mornings. There are, however, very few periods after 6:00 A. M. on Saturday morning when less than one-third of the potential rural homemaker audience is tuned to some station. With the exception of the evening hours, a slightly greater proportion listens between 6:00 and 8:00 A. M. and between 12:00 noon and 1:00 P. M. than at other times. Relatively fewer farm women listen to the radio on Saturday afternoon than during the week-day afternoons. This may be accounted for by the previously mentioned Saturday habits of rural dwellers. In this connection it is interesting to note that proportionately more farm women seem to stay up late on Saturdays to listen to the radio than do rural men.

Area differentials in listening patterns of rural homemakers are not great. One apparent fact, however, is that proportionately more of the women in the Ruston area both turn on their radios earlier and listen

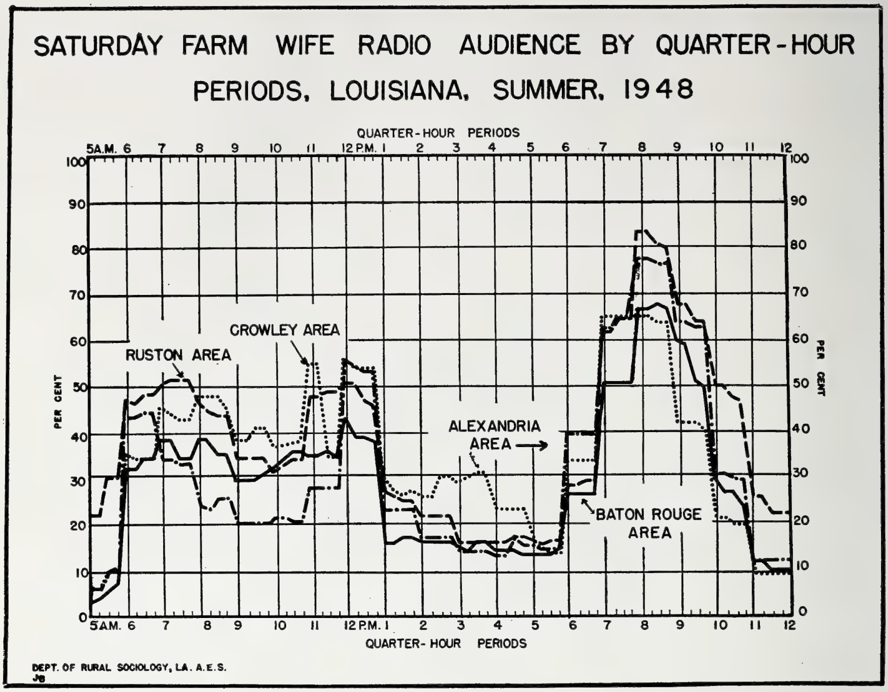


Figure 5.—Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Saturdays, Four Farm Survey Areas, Louisiana, 1948.

to them later than do the women in the other areas. Relatively fewer women in the Alexandria area, on the other hand, listen to their radios during the mid-morning hours on Saturday. In the Crowley area, proportionately more women listen regularly during the afternoon hours than do the women from the Baton Rouge, Ruston, and Alexandria survey areas.

Sunday Listening Habits

One might suppose that rural people listen to the radio more on Sundays than on week-days or Saturdays. In order to test the validity of this hypothesis, all informants who owned radios were asked to list the hours during which they regularly listen on Sunday. The responses given by the farmers are shown in Figure 6, and those given by farm women appear in Figure 7. A glance at these figures makes it clear that the Sunday listening habits of rural people are quite different from their week-day and Saturday listening patterns.

The Sunday Listening Patterns of Farmers. The data suggest several conclusions with respect to the typical Sunday listening patterns of farmers. In the first place, the number of men listening to their radios on Sunday morning is small, much smaller than during the same period on week-days and on Saturday. This is, no doubt, due to the fact that

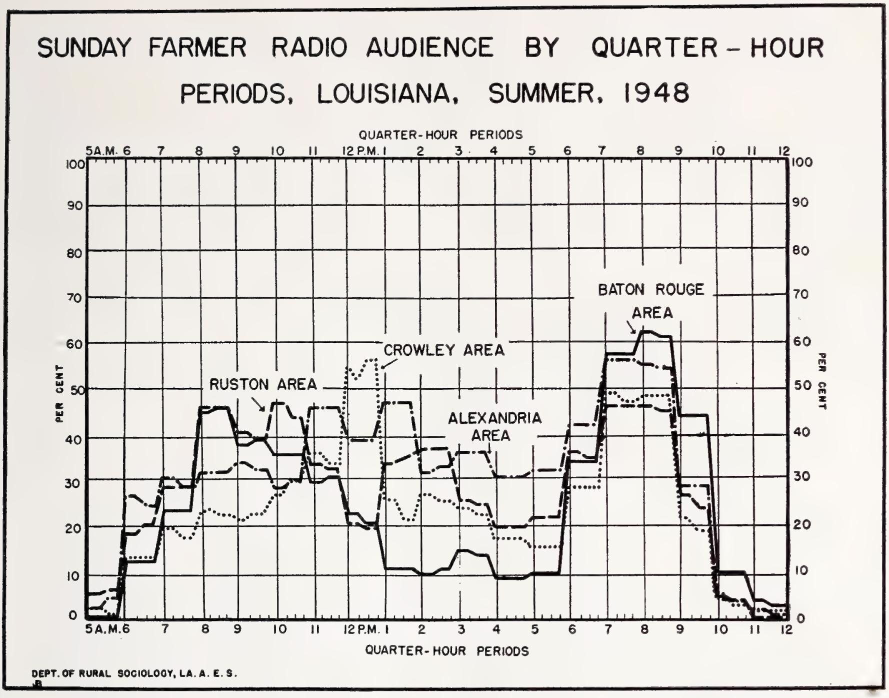


Figure 6.—Proportions of Farmers Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Sundays, Four Farm Survey Areas, Louisiana, 1948.

rural people, like urban people, do not arise as early on Sunday. Second, unlike on other days, the respective listening curves do not build up to a definite peak around 8:00 A. M. and at noon; rather, there is a gradual increase in the proportion of farm men listening until 8:00 A. M., followed by a leveling off with only minor changes in the morning. The afternoon listening curve drops slightly from the morning level until 7:00 P. M. After this time it indicates an increase in the proportion listening, but the curve never rises as high or shows as distinct a listening peak as on week-days or Saturday. In fact, just over half of the men are listening during what are generally conceded to be the most popular Sunday evening hours—from 7:00 to 9:00 P. M. Relatively few farm men report the habit of listening to their radios after 10:00 P. M. on Sunday.

Area differentials in the Sunday morning listening habits of farmers apparently stem for the most part from differences in church affiliations and attendance. In the Crowley area, which is characterized by a large proportion of Catholics, the listening curves are relatively low until 10:00 A. M., but show a large audience after this time. On the other hand, the Ruston and Baton Rouge areas, with larger proportions of Protestants, have small radio audiences from 10:30 A. M. to 12:45 P. M. The listening curve of the Alexandria area occupies an intermediate position, one which falls between those of the areas described above.

The Sunday Listening Patterns of Farm Wives. The farm women show more decided preferences for particular listening hours than do the farm men. Note that the listening curves shown in Figure 7, in contrast to those in Figure 6, exhibit fairly well defined listening peaks. During the period from 8:00 to 10:00 A. M. (except for the Crowley area) and from 7:00 to 9:00 P. M., a greater proportion of the women give attention to their radios. On the other hand, the time from 12:00 noon to 1:00 P. M., with the exception of the Crowley area, is, unlike week-days and Saturdays, one of the least popular Sunday listening hours for the wife. The differences in religious affiliation again presumably account for the particular pattern of the Crowley area. Like their husbands, farm women do not listen to the radio as early in the morning or as late in the evening on Sundays as they do on Saturdays.

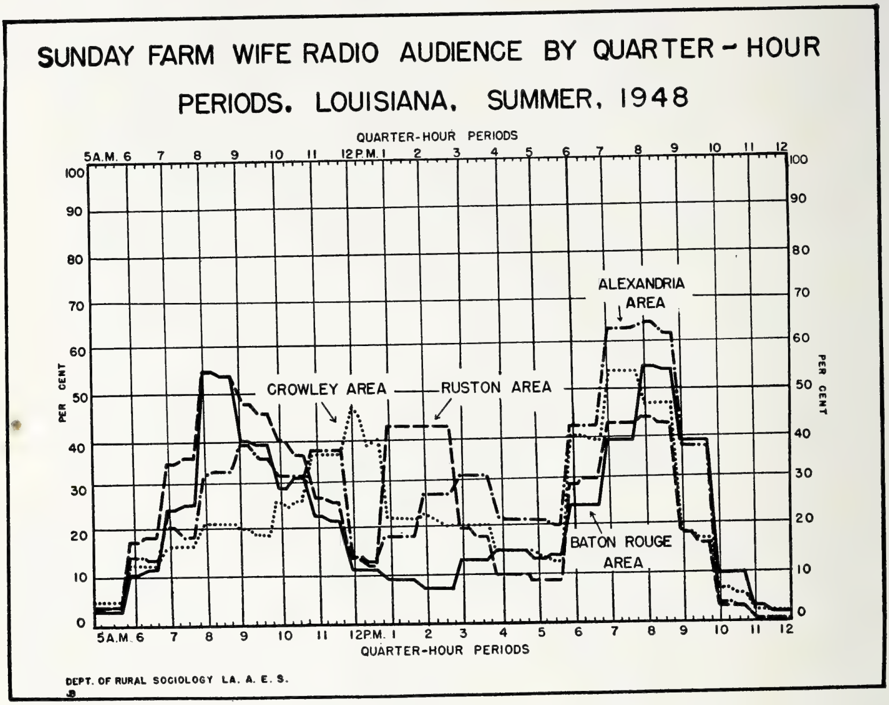


FIGURE 7.—Proportions of Farm Women Interviewed Who Reported Listening Regularly to Their Radios at Specified Times on Sundays, Four Farm Survey Areas, Louisiana, 1948.

Area differentials, except for the ones noted above, are not very pronounced. It seems likely, however, that programs heard between 1:00 and 2:30 P. M. in the Ruston area have great appeal to the farm women. Also apparent is the fact that proportionately more of the Alexandria area farm wives listen to their radio on Sunday afternoon and evening.

Time Preferences for Winter and Summer Farm Broadcasts

Winter farm activities differ in degree and kind from summer farm activities. Therefore, the time preferences of rural-farm people for farm radio programs may be expected to differ between these two seasons. In order to determine if this is the case, all interviewees were asked what quarter-hour intervals of day or night would be most convenient for them to listen to a farm and/or homemaker program during each of the two seasons. Their answers were recorded and tabulated, and appear in Figure 8.

Summer and Winter Time Preferences of Farmers. Farmers who specify summer time preferences for farm radio programs mention the quarter-hour period from 12 noon to 12:15 P. M. more often than any other time. See Figure 8. The period from 7:00 to 7:15 P. M., on the other hand, is the second most popular summer broadcast time among farmers, and the period from 8:00 to 8:15 P. M. is the third most popular. The reader will note that the farmer's winter time preferences follow the same pattern. There is, however, one important difference. The period from 8:00 to 8:15 P. M., although still ranking in third place, is not nearly as popular during the winter as it is during the summer. This suggests that farmers tend to stay up later during the latter season. Significantly, the first and second choices in time preferences do not show pronounced

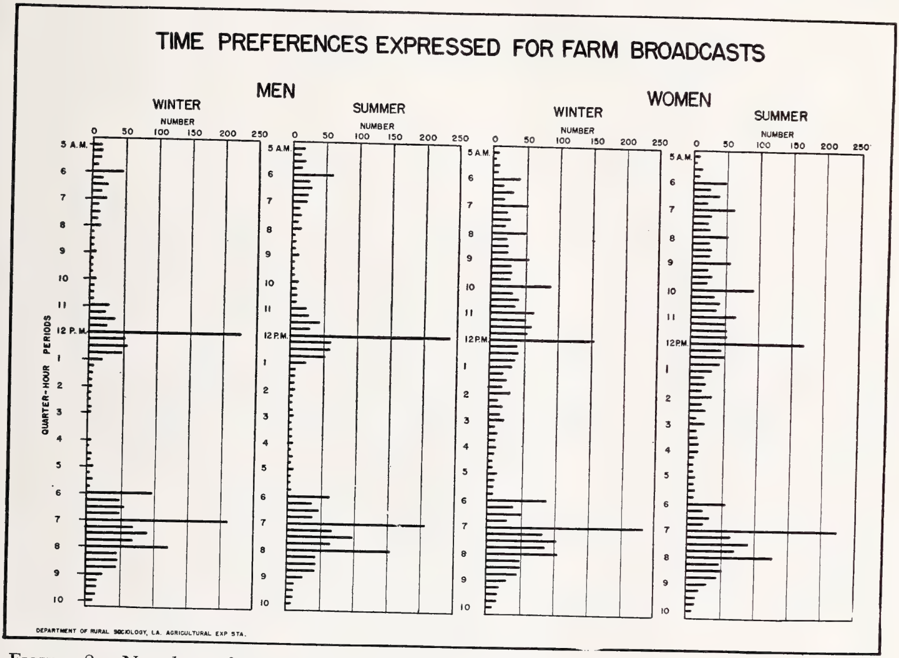


FIGURE 8.—Number of Persons Expressing Preferences for Specific Times for Summer and Winter Farm Broadcasts, by Sex, Total Sample of Four Farm Survey Areas, Louisiana, 1948.

seasonal differences. Approximately the same number of farmers mentions them for both periods.

Summer and Winter Time Preferences of Farm Wives. Farm women differ in two respects from farm men in regard to expressed seasonal time preferences for agricultural broadcasts. In the first place, larger numbers of the women specify a greater variety of periods when they would prefer to hear such broadcasts. In the second place, they differ from the men concerning times most preferred for hearing farm broadcasts. Greater numbers of the female informants specify 7:00 to 7:15 P. M. for both summer and winter listening. Twelve noon is their second choice, and 8:00 P. M. their third for both seasons. Little difference appears in the number who mention each of the above times in summer or winter.

The above findings suggest both that certain hours fall at "slack" work times during the two seasons, and that these times are so arranged that influence of the seasonal pattern of work on preferred listening times is not pronounced.

IV. RADIO PROGRAM PREFERENCES

It is important for the broadcaster to know what the program preferences of the farmer and homemaker are. The significance of such knowledge is readily apparent. Only after the type of program preferred by farm people is ascertained and implemented will the agricultural radio presentation be assured of audience appeal. These presentations can include or leave out various specific types of programs such as news, market reports, and weather reports according to the amount of interest manifested in them. As was previously mentioned, the classification of program preferences was the second purpose of the present study.

The discussion which follows is divided into two major parts. The first deals with the preferences of farm people for broad categories of programs. It is designed to determine what the farmer or homemaker considers to be the best general type of program. The second part is concerned with the relative interest of farm groups in various specific types of programs. All analyses include sex and area breakdowns.

General Categories of Programs

Each person interviewed was asked to name the four day and the four night radio programs that he liked best in order of preference. Of course, some people could not, offhand, name this many programs that they liked. The names of all the programs given, however, were duly recorded and later classified (after consultations with radio program directors) according to type. As far as could be determined, the breakdown of preferences by day and night periods is a unique procedure in the study of radio program preferences. It was felt, however, that there was enough evidence to indicate that preferences differed sufficiently between these two times to warrant getting the additional information. The results obtained justified the time and effort expended.

Because up to four choices of programs were recorded, two types of statistical analyses were possible. The simplest procedure would have been the computation of the percentage distribution of the first choices listed. It was felt, however, that a more accurate portrayal of program preferences could be obtained by a weighted index of all choices named.[7] This index or composite score was arrived at by assigning a weight of 4 points to first choices, a weight of 3 to second choices, a weight of 2 to third choices, and a weight of 1 to fourth choices. In instances where less than four choices were reported, all preferences given were scored. The results of these scores appear in Figures 9 and 10.

Day Program Preferences. When rural-farm people are considered as a group, there is no doubt as to the type of day program that they prefer. News programs stand out as their favorite. In fact, almost one-third of the total composite score of all day program preferences is for news programs. This discovery speaks well of the farm people's interest in local, national, and even international affairs. The second choice of the ruralites in general categories of day programs is music. As can be seen in Figure 9, over one-fourth of the composite score of program preferences is for this type of program. Drama ranks third among the preferences of the rural-farm population, accounting for almost one-fifth of the total composite score. This fact may surprise some readers until they discover that the farm women are avid listeners to daytime serials. Fourth among the choices of the farm people are comedy and variety programs. To this category is allotted one-eighth of the total score of day program preferences. Informational and educational programs rank fifth. Such programs, however, account for only a small proportion of the total score, a fact which seems worthy of the consideration of radio program planners. The sixth preference is for religious programs, and the seventh for sports.

While the overall picture of farm people's day program preferences is of much general interest, it is more practical to know what differences exist between the sexes and among the areas. Figure 9 shows these preferences for men and women by study areas.

An examination of Figure 9 shows that farm men have a decided preference for news as a daytime program. Of the total composite score of farmers' radio program preferences, well over two-fifths is for news presentations. Music is also in demand by the men as a day program. It ranks second in their choices and accounts for about one-fourth of the weighted score of the first four preferences listed. In third place, but accounting for only one-tenth of the total score, are comedy and variety presentations. In fourth place and almost as popular as comedy and variety are informational and educational programs. Drama programs

---

[7] It may be noted that a comparion of the rankings of program preferences according to first choices and composite score shows very little variation.

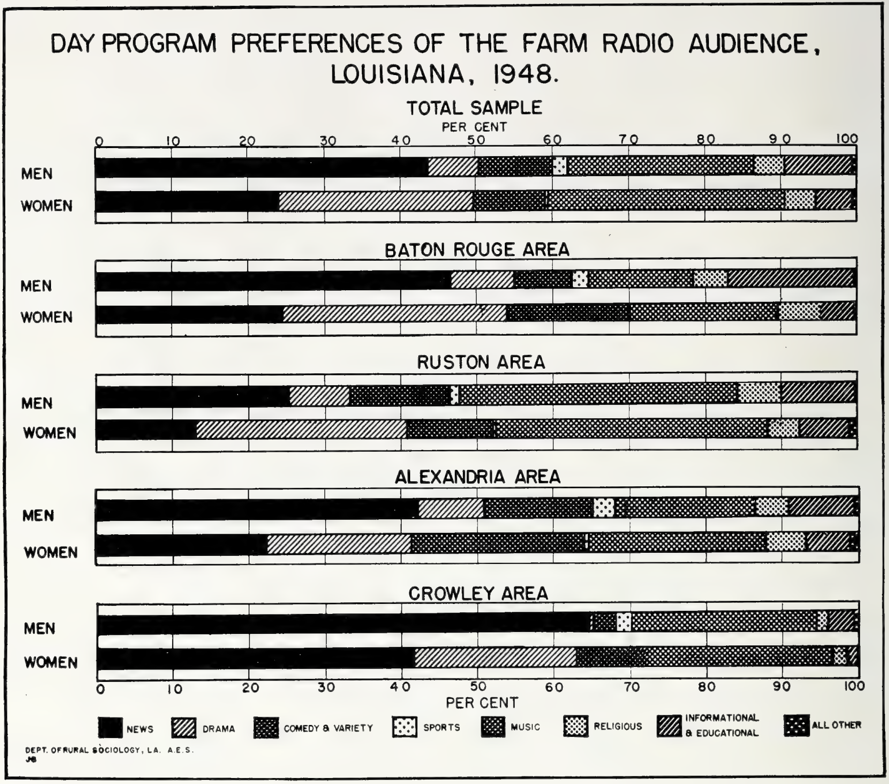


FIGURE 9.—Proportions of the Farm Radio Audience Expressing Preferences for General Categories of Day Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

rank fifth, but account for only a small proportion of the composite score. Religious and sports presentations are relatively insignificant among the choices of farmers. The former rank sixth and the latter rank seventh.

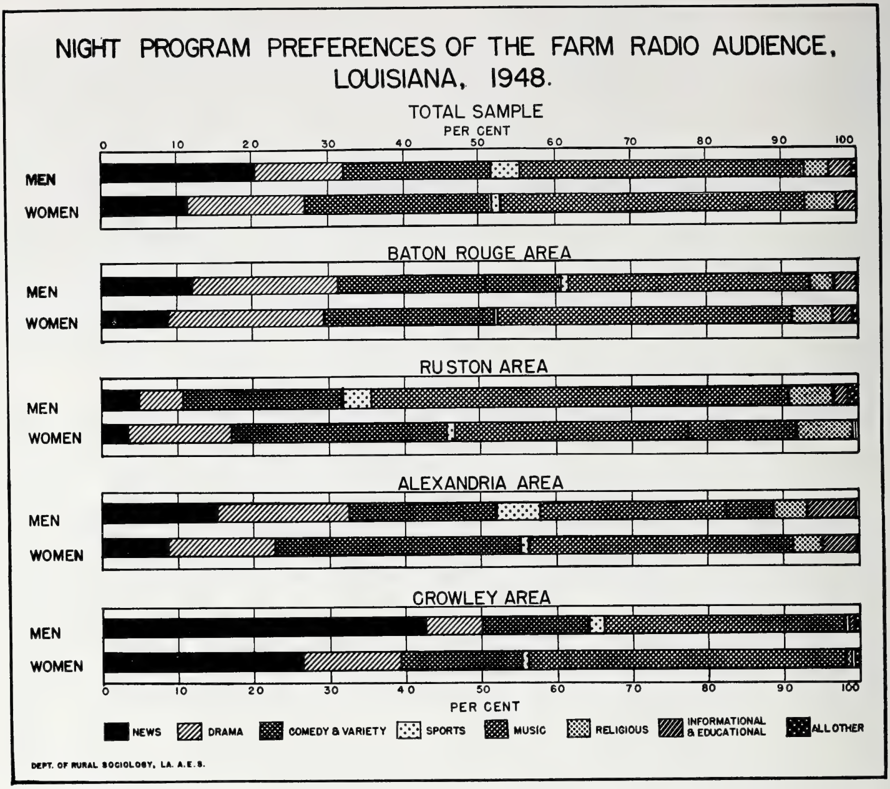
Area differences in the program preferences of men are worthy of note. On the basis of comparative composite scores, the first choice of the farmers of the Baton Rouge, Crowley, and Alexandria areas is news programs, whereas the first choice of those from the Ruston area is music. Isolation of the precise cultural factors which cause this differential requires more investigation. Another interesting fact is that music programs do not seem to be as popular in the Baton Rouge area as in the other areas. Informational and educational programs, in contrast, enjoy their greatest popularity in the Baton Rouge area. The men from the Crowley area show almost no interest in informational and educational and drama programs, while those from the other areas exhibit but little more interest in these programs. Comedy and variety programs are not as popular in the Baton Rouge and Crowley areas as they are in the Ruston and Alexandria areas.

It is of significance to make comparisons between farmers and their wives with respect to program preferences during the day. An analysis of the program preferences of farm wives reveals at once that while the women do not exhibit as much interest in the news as a day program as do their husbands, it is important that they do exhibit enough interest to rank such programs as their third choice. Almost one-fourth of the composite score of their day preferences is for news programs. Their first choice, however, is music. Drama programs are a close second among their preferences, and comedy and variety programs are fourth. Informational and educational, and religious programs are fifth and sixth, respectively, but are relatively insignificant. Sports programs apparently could be left off the air almost completely as far as the farm ladies are concerned.

Like their husbands, farm women express definite patterns of day radio program preferences by area. Examination of Figure 9 shows that the women in the Crowley area are much more interested in news than are the women in the other areas. This may be because news programs are often offered in French, the only language which many understand and which even more prefer to hear. In contrast, the women in the Ruston area show least interest in the news. They show considerably more interest, however, in music as a day program than do the corresponding group of listeners from the other areas. Comedy and variety programs appeal more to the wives from the Alexandria area than to those from the Baton Rouge, Ruston, and Crowley areas. At the same time, the females in the Alexandria area are less favorably disposed toward drama programs than are their counterparts in the three remaining areas. Although not much interest is shown in informational and educational, and religious programs as a whole, the farm wives in the Crowley area express less interest in these two general categories of programs than do those in the other areas.

Night Program Preferences. This section is devoted to an analysis of programs preferred for night listening. It considers both men and women, and all discussion pertains to the time between 6:00 P. M. and midnight. With the coming of evening, when persons have more leisure time and want to relax after a day's labor, it seems only natural for them to desire a radio program that is of a recreational nature. That farm listeners follow this pattern is demonstrated in Figure 10. Their overwhelming first choice (almost two-fifths of the total composite score) for evening listening is music.

Ranking second (and further lending credence to the hypothesis stated above) are comedy and variety programs. There is, however, quite a gap between first and second choices, as is testified to by the percentage of the total score of listening preferences allotted to each (see Figure 10). News programs rank third in the preferences of the farm audience, although they are far from attaining the popularity they achieve as a day program. Drama ranks as fourth choice, accounting for slightly over


NIGHT PROGRAM PREFERENCES OF THE FARM RADIO AUDIENCE, LOUISIANA, 1948.

DEPT. OF RURAL SOCIOLOGY, LA. A.E.S.

FIGURE 10.—Proportions of the Farm Radio Audience Expressing Preferences for General Categories of Night Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

one-eighth of the total score. The percentages of the composite program preference score ascribed to religious, informational and educational, and sports programs are almost negligible. When only men are considered, it is found that relatively more of them prefer musical programs than any other type for night listening. Just less than two-fifths of the men's total composite score is in this category. News, however, is also a popular night program with the men. Such programs rank second in their preferences and account for one-fifth of their composite score. A good deal of interest is also shown in comedy and variety programs, as is witnessed by the fact that this type ranks third with the men and claims almost as high a percentage of the total score as does news. It is interesting to note that drama programs rank fourth. Sports and religious programs are not much in demand and rank fifth and sixth, respectively, as choices for night listening.

Area differences among night program preferences of the men are as significant as those for day preferences. In comparison with men from the other three areas, Crowley farmers are much more interested in news programs. The Ruston area farmers have least interest of all in news as a night program. Drama programs appeal more to the farm men of the Baton Rouge and Alexandria areas than to those of the Ruston and Crowley areas. Comedy and variety programs are most popular in the Baton Rouge area and least popular in the Crowley area. Music programs are much more popular in the Ruston area among the men than in any of the remaining three areas. The farmers in the Ruston area appear also to be the most interested in religious programs, while the Crowley men are the least interested in these presentations. Informational and educational programs attract the largest audience among the men of the Alexandria area, although even here such broadcasts do not rate particularly high among night program preferences. Again, in conclusion, one may observe that area differences in program preferences seem to reflect prevailing differences in culture patterns.

At night, farm wives like musical programs best. Unlike their husbands, however, they rank comedy and variety programs as their second choice. News and drama rank third and fourth, respectively, followed by religious programs. While informational and educational programs are of more interest to the women than are sports programs, neither type enjoys any considerable attention from this group of radio listeners.

Similar, if not as pronounced, patterns of area differences are evident in the data showing night program preferences of farm women. While the women from all areas indicate that music is their first choice for evening listening, proportionately more women from the Crowley and Ruston areas share this preference. News programs hold very little interest for any but the rural wives of the Crowley area. Although the Baton Rouge area women show the most interest in drama programs, considerable numbers from the other areas also report liking this category of programs. Comedy and variety programs enjoy some popularity in all areas, but proportionately more of it in the Ruston and Alexandria areas than in the other two. The women in the Crowley area show least interest in religious programs for night presentations, whereas those in the Ruston area exhibit the most. Only in the Baton Rouge and Alexandria areas is there any appreciable interest manifested in informational and educational programs.

Specific Types of Programs

Although the agricultural broadcaster possesses valuable information when he knows the preferences of farm audiences for general types of programs, he can use more detailed and specific facts to good advantage. In order to clarify further the whole matter of program preferences, the interviewees were asked to express their likes and dislikes of programs falling under specific headings. The resultant findings are presented below.

Types or Kinds of Music. In the preceding section it was determined that farm people place music programs among their top preferences. It now becomes important to know what particular kind of music they want to hear. In order to determine specific preferences, each in-

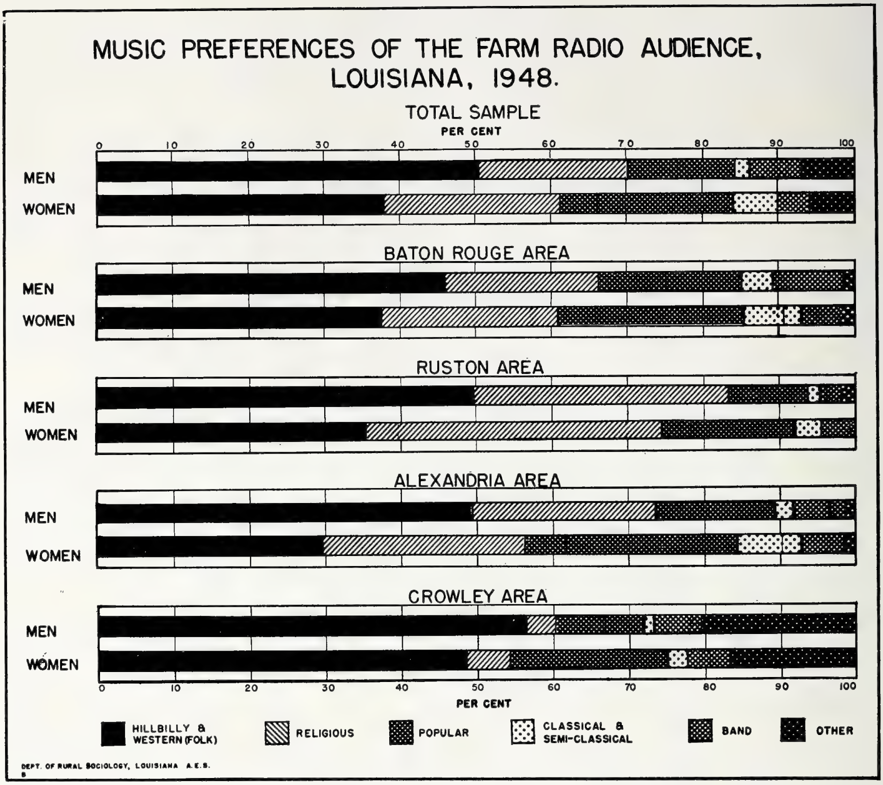


FIGURE 11.—Proportions of the Farm Radio Audience Expressing Preferences for Specific Types of Music Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

formant was asked to list the three types of music he liked best in order of preference. The responses received were worked up into a composite score in the same manner as were the general program preferences. Figure 11 was prepared from the data to indicate these specific preferences. It might be mentioned that the percentage distribution of the first choices listed gives approximately the same rankings as that of the composite scores.

A comparison of the scores shows that by far the most popular type of music is "western" and "hillbilly," often referred to as folk and folk-type music. More than two-fifths of the composite score is accounted for by this category. In view of the relatively deep religious attitudes held and preserved by farm people, it is not surprising to find that religious music ranks as the second choice among music programs of all kinds and includes over one-fifth of the total score. Not far behind in popularity is so-called "popular" music. Just under one-fifth of the composite score falls in this category. Band and "other" types of music are far down the list of preferences, and classical and semi-classical types are rarely mentioned.

Proportionately more of the men interviewed show a preference for "western" and "hillbilly" music than any other. In second place among the farmers' preferences is religious music. This bears out the hypothesis that agrarian groups are partial to religious presentations. "Popular" music ranks only a poor third among the preferences of farmers. Some interest in band music and classical or semi-classical music is evinced, but it is safe to say that, as far as men are concerned, there is very little demand for these types.

Area differences in program preferences among rural men are just as pronounced as differences of opinion on programs themselves. More of the men show a preference for religious music in the Ruston area than in the other areas. In contrast, the men in the Crowley area exhibit hardly any interest at all in this type of music. Relatively more of the farmers in the latter area report an interest in "western" and "hillbilly" music. Nearly all the men interviewed, however, regardless of area, show marked enthusiasm for this type. Band music is least popular in the Ruston area and most popular in the Baton Rouge area. "Popular" music attracts a considerably greater following among the farmers of the Baton Rouge and Alexandria areas than among those of the other two areas. Although they enjoy but little popularity anywhere, the classical and semi-classical types of music have a higher score rating in the Baton Rouge area than elsewhere.

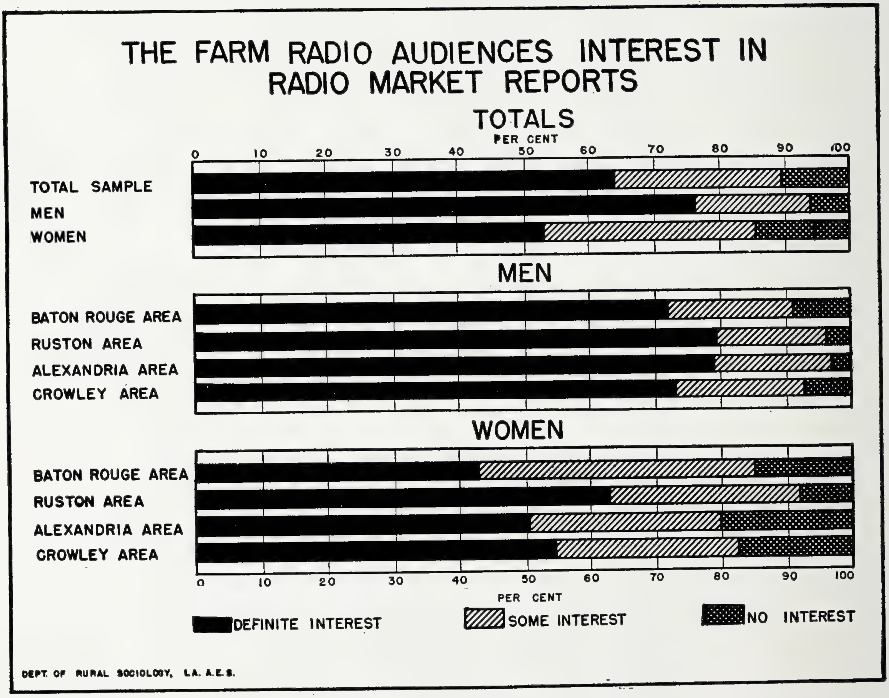
The reader may inquire as to the reasons why so large a percentage of the Crowley area total score falls in the category of "other" types of music. This is readily explained by the fact that many of the interviewees there listed "French music" as their first choice. Since this is a distinctive kind of music which includes a varied combination of folk-type and plain "hillbilly" songs in the French language, this classification was included among "other" types in the analysis.

Adult rural women tend to have the same preferences as the rural men, but express somewhat less favor for "western" and "hillbilly" music. This type, however, ranks first among their choices. The women also place religious music as their second choice. Here, though, as might be expected, they show relatively more interest than their husbands. "Popular" music follows religious music very closely among their choices. "Other" types of music, classical music, and band music are the least popular among the rural women who expressed an opinion.

Area differences in music preferences among the women are similar to those observed among the farm men. The women from the Crowley area have very little interest in religious music, while those from the Ruston area classify this type of music as their first choice. On the other hand, "western" and "hillbilly" music is accorded a much better reception in the Crowley area than anywhere else. Women in the Alexandria area show the least interest in this type, to which is allotted almost three-tenths of their composite score. "Popular" music enjoys its greatest relative popularity in the Baton Rouge and Alexandria areas, as does classical music. The latter type, however, does not have an appreciable following in any of the four areas. Again, a considerable proportion of the total score of the Crowley area is accounted for by the "other" category. This can be explained, as before, in terms of an expressed preference for the local types of French folk music.

Interest in Radio Market Reports. News, as was brought out in the first part of this section, ranks very high among the preferences of the farm audience. There has, however, always been some doubt as to the demand for particular types of news in rural areas. One of the controversial subjects in relation to news broadcasting is the extent of farm people's interest in market reports. This question in its entirety, of course, involves not only the matter of whether or not to have market reports at all, but also a consideration of what should be included in these reports. In this particular survey, all informants were asked to state their interest in such reports, and their responses were classified into the three following categories: those showing definite interest, those showing some interest, and those manifesting no interest. The results of the tabulation of these responses appear in Figure 12.

From a study of this chart it can be concluded that substantial proportions of farm people are keenly interested in market news. Almost two-thirds of the informants responding to this question express a def-



DEPT. OF RURAL SOCIOLOGY, LA. A.E.S.

FIGURE 12.—Proportions of the Farm Radio Audience Expressing Specified Degrees of Interest in Broadcasts of Market Reports, by Sex, Four Farm Survey Areas, Louisiana, 1948.

inite interest in such programs. One-fourth of the respondents voice mild interest in such reports, and only one-tenth indicate no interest in such presentations.

Sex breakdowns give more insight into this area of radio reporting. When the responses of the men interviewed are considered separately, it becomes evident that decidedly more of them have an interest in market reports. For example, over three-fourths of the farmers express very definite interest, as compared with only slightly over half of the farm women. Only a little over one out of twenty of the men have no interest in market news, while almost one out of six of the women express a complete lack of interest. The causes of these differences seem fairly obvious. The men, as a rule, have more responsibility for marketing, and thus more interest in the market news. That a few men do not indicate interest in such news is probably explained by the fact that some of them produce little more than they consume at home, while others, too, are perhaps characterized by a general lack of interest in such matters.

Although area differences appear in respect to interest expressed in market reports, they are not pronounced. All areas consistently show that men have more concern for such reports than women. Both the men and the women of the Baton Rouge area display less interest than corresponding groups in the other areas. It may be observed, however, that there are greater area differences in interest among the women than among the men.

Interest in Radio Weather Reports. Very few occupational groups are as critically concerned with the weather as are farmers. Although from a long-time standpoint farm people may have some tendency to be philosophical about the weather, a keen and growing regard for day by day forecasts is both natural and expected. In this respect the question is whether or not farmers have enough interest in or enough confidence in the radio weather reports to want such a broadcast. For this reason a question designed to ascertain such information was inserted in the schedule. The answers were tabulated and appear in Figure 13.

Five out of six of the adult farm people interviewed have a definite interest in radio weather reports. This proportion indicates a widespread interest among farmers in this type of radio offering. Another one-tenth have some interest in weather reports, and only a very few display no interest whatever in such presentations. These findings should be sufficient to remove any doubt but that farm people want weather information.

It is apparent that radio weather forecasts are more in demand by men than by women. Of the men, who do most of the outdoor work, less than one out of fifty has no interest in weather reports. Furthermore, over nine out of ten of them have definite interest in this type of broadcast. The fact that this is the case for only four-fifths of the women

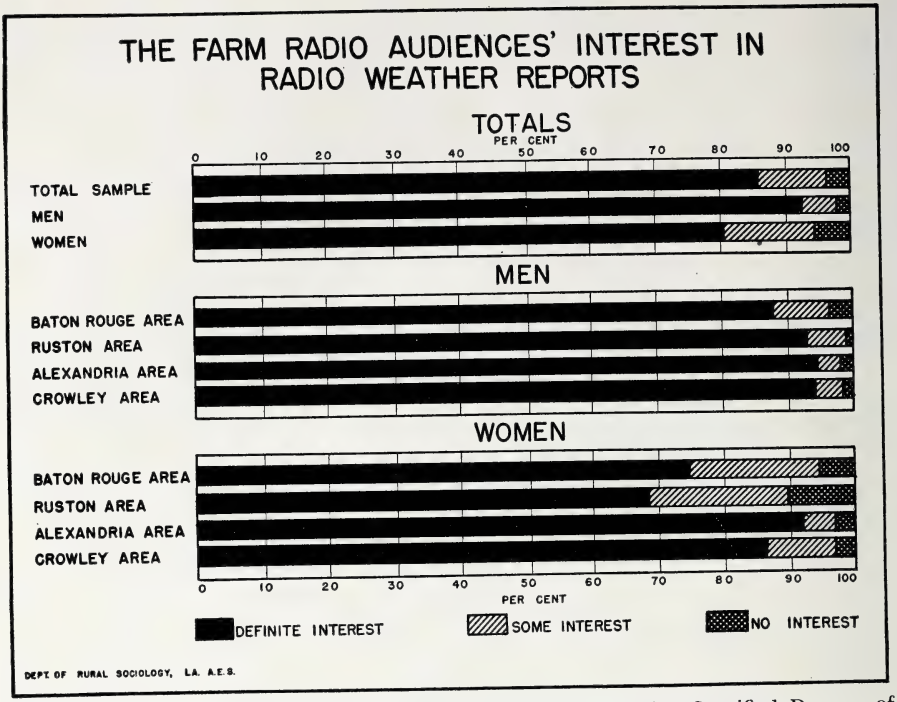


FIGURE 13.—Proportions of the Farm Radio Audience Expressing Specified Degrees of Interest in Broadcasts of Weather Reports, by Sex, Four Farm Survey Areas, Louisiana, 1948.

is understandable in view of their less active participation in outdoor farm activities.

In regard to area differences, it appears that the farm people from the Baton Rouge and Ruston areas display slightly less interest in radio weather reports than those from the Alexandria and Crowley areas. When the men are considered separately, however, these differences tend to disappear. On the other hand, when the women are analyzed as a group it is found that these differentials are exaggerated.

Interest in the County or Home Agent's Broadcasts. Informational and educational programs do not rank very high among the listening preferences of farm men and women. This makes it important to study the rural audience's interest in county or home agent's broadcasts. In order not to bias the reply of informants, this point was approached in an indirect manner. The interviewees were simply asked how often they listened to the county agent's or home agent's broadcasts. Their answers were classified in three categories: regularly, sometimes, and never. The data appear in Figure 14. Those informants who indicated that they listen to such broadcasts sometimes or never were asked to indicate their reasons for so doing. These responses are presented in Figure 15.

It will be gratifying to county and home demonstration agents to

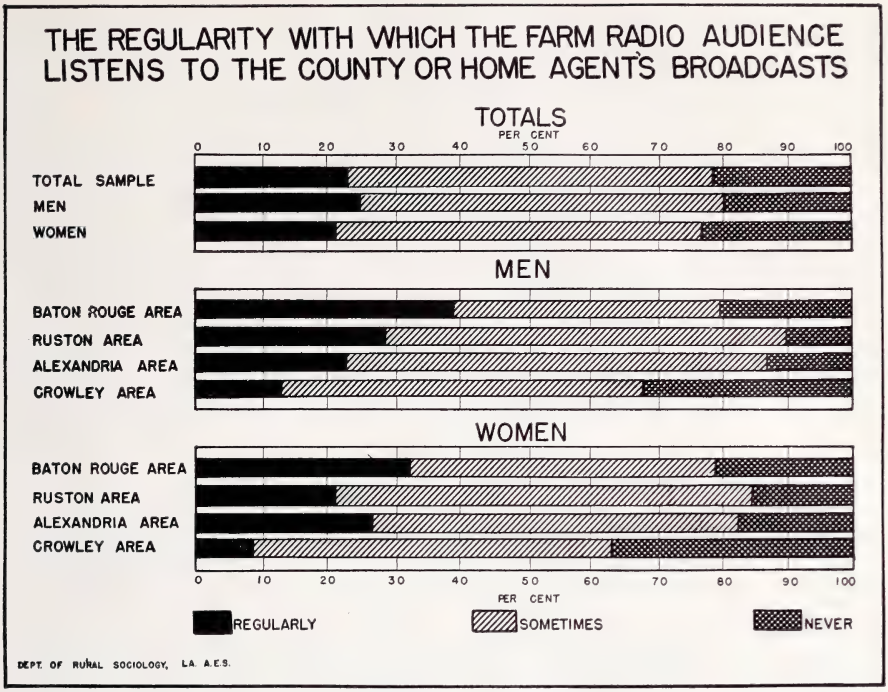


FIGURE 14.—Proportions of the Farm Radio Audience Reporting Specified Patterns of Listening Regularity to County and Home Demonstration Agents' Broadcasts, by Sex, Four Farm Survey Areas, Louisiana, 1948.

find that about one-fourth of the adult farm audience listens to them with regularity, and that an additional one-half listens to them part of the time. It will be valuable even if not encouraging for them to learn that over one-fifth of this audience never listens to them. The responses concerning time preferences discussed in Section III indicate that a program from 12:00 noon to 1:00 P. M. would have a maximum number of regular listeners. But these overall figures for this type of broadcast are not as important for analytical purposes as are those between sexes and among areas.

County agents have a regular audience of one-fourth of the farm men interviewed in all areas. In addition to these, well over half of the males listen to them sometimes, while just less than one-fifth never hear such programs. Area analyses show that a greater proportion of the farmers in the Baton Rouge area are regular listeners. The Crowley area, on the other hand, has proportionately fewer regular listeners than the other three.[8] While the Crowley area has more men who never listen to such broadcasts, the Baton Rouge area ranks next to it in this respect.

---

[8] The remarks of interviewees in this area suggest that extension broadcasts in French would be accorded a much better reception. In fact. the writers are convinced that any program in this language would have a considerable audience.

The home demonstration agents who broadcast have a regular audience of just more than one out of five of the rural women in the areas studied. Almost one out of four, however, never listen to their home agents' broadcasts. Proportionately the largest group of regular listeners is in the Baton Rouge area. The women from the Ruston area, however, are also relatively consistent listeners. In contrast, less than one-tenth of the women of the Crowley area listen to their home agents regularly. The Crowley area also leads in the proportion of farm women who never listen to the home agents' broadcasts. As is the case with the men, the Baton Rouge area is second in this respect, although, as before, it has the highest proportion of regular listeners.

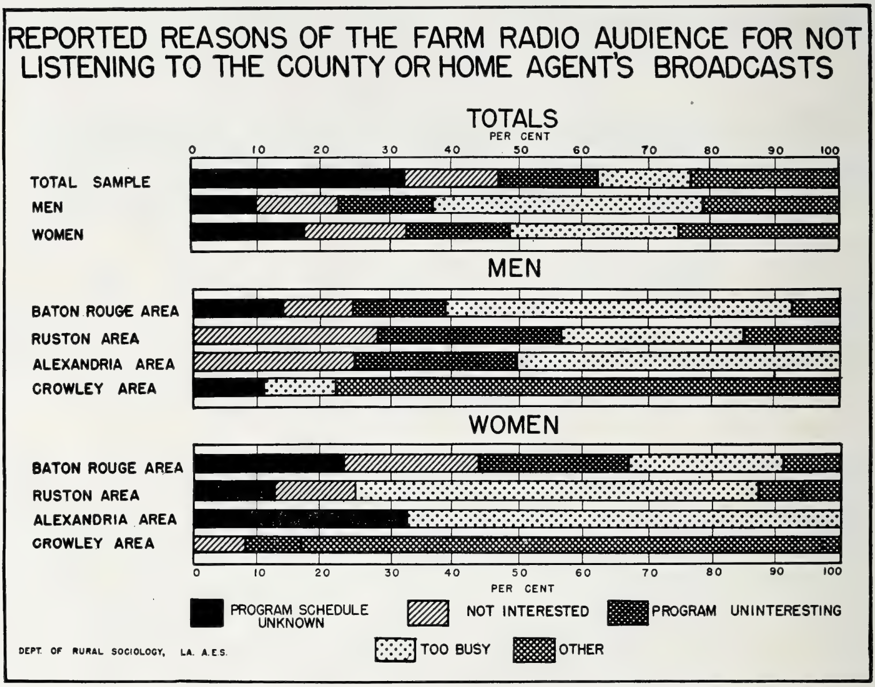


FIGURE 15.—Proportions of Farm Radio Audience Reporting Specified Reasons for not Listening to Broadcasts by County and Home Demonstration Agents, by Sex, Four Farm Survey Areas, Louisiana, 1948.

As has been mentioned, an attempt was made to ascertain why the rural men and women who never listen to broadcasts do not do so. Although the number responding to this query was small and hardly sufficient to serve as a basis for reliable conclusions, the reasons cited nevertheless indicate why some farm people do not take advantage of the opportunity of listening to county or home agent broadcasts.

It seems significant that exactly one-third of the reasons given attributed not listening to county or home agent broadcasts to the lack of information as to the times such programs are scheduled. This is something which could be remedied without undue difficulty on the part of the agents.

"Other" reasons rank second in importance as causes for not listening to farm programs. This category, however, is unduly influenced by the proportion of persons from the Crowley area, over four-fifths of whom reported their reason for not listening was the fact that they could understand little or no English. The agents in that vicinity should take cognizance of this situation. In this respect it was indicated that those who could understand English would still prefer a program in French. Other factors named which appear important in this connection are that such programs are not interesting, that the interviewees are too busy, or that they are just not interested.

V. PREFERENCES CONCERNING OTHER ASPECTS OF RADIO PROGRAMS

Even after learning what types of programs farm people like, the broadcaster still does not have a complete picture of their program preferences. In addition, it is important for him to know something of the likes and dislikes of this audience with respect to other aspects of programs. With the aim of securing reliable information in this relatively unexplored field of rural radio listening research, several pertinent questions were included in the schedule. The responses of the interviewees to these queries have been tabulated and expressed in graphic form and are discussed in the following pages.

Length of Farm Programs

Among the more vital factors which go into the makeup of a radio program is its length. It should be long enough to make a satisfactory presentation possible, yet not so long as to lose the listeners' interest or take up too much radio time. In order that the farm broadcaster might have some guide on this point, all informants were asked to state their preferences regarding the length of farm program they would like to hear. Their answers are portrayed in Figure 16 and are discussed below.

As a group, the farm radio audience is overwhelmingly in favor of the 15-minute program. Over three-fourths of the respondents state that they prefer a program of this length. Preferences for 10-minute programs are expressed by less than one out of ten of the interviewees, and preferences for 5-minute programs by only about one out of every twelve interviewees. Slightly over one-tenth of them say that they prefer to listen to a program longer than 15 minutes.

Interestingly enough, identical percentages of men and women informants indicate a preference for 15-minute programs. What seems unusual, since the time element is supposedly more important for men, is the fact that proportionately more of them than women voice a desire for programs longer than 15 minutes. Very few informants of either sex

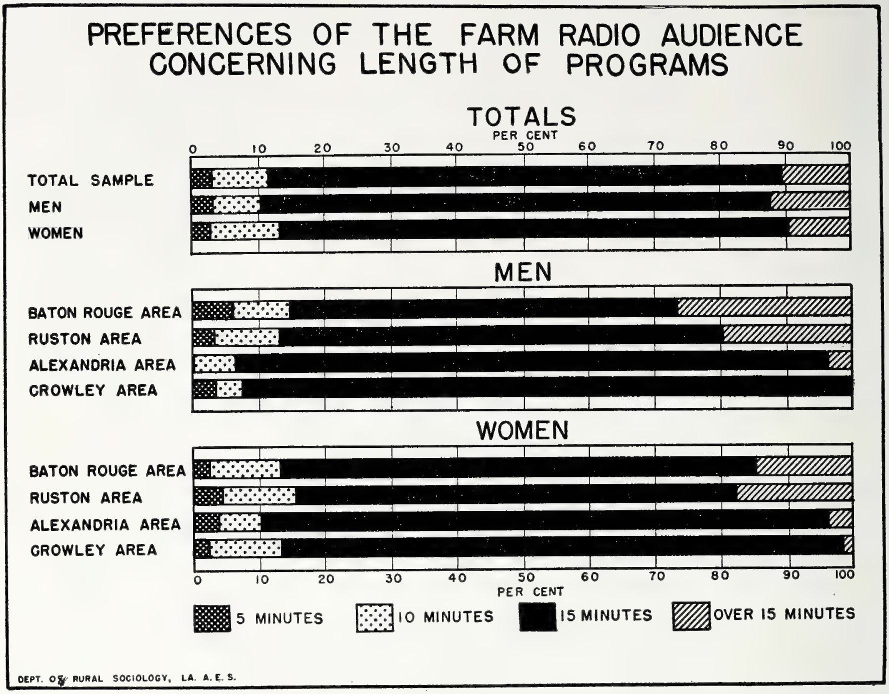


FIGURE 16.—Proportions of Farm Radio Audience Expressing Preferences for Particular Lengths of Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

are in favor of 5-minute programs. Proportionately more women, however, express a preference for 10-minute programs.

There are few significant differences among the areas concerning the most desirable length of farm programs. The majority from all areas express a preference for 15-minute programs. However, relatively more persons in the Baton Rouge and Ruston areas manifest a preference for programs both of longer and shorter duration.

Number of Persons on Farm Broadcasts

The number of participants on a program is likely to have much to do with its reception. Of course, it is readily acknowledged that some programs better lend themselves to either single or multiple participation. In the main, however, there is a considerable leeway in this respect. Farm programs usually may be varied from the reading of a manuscript on the one hand to a question and answer type of program or a panel discussion group on the other. To determine which of these two general types (one utilizing one person and the other utilizing two or more persons) that the rural audience favored, all informants were asked to indicate the number of persons they prefer on farm broadcasts. These responses are charted in Figure 17.

Over three-fourths of all the interviewees express a preference for

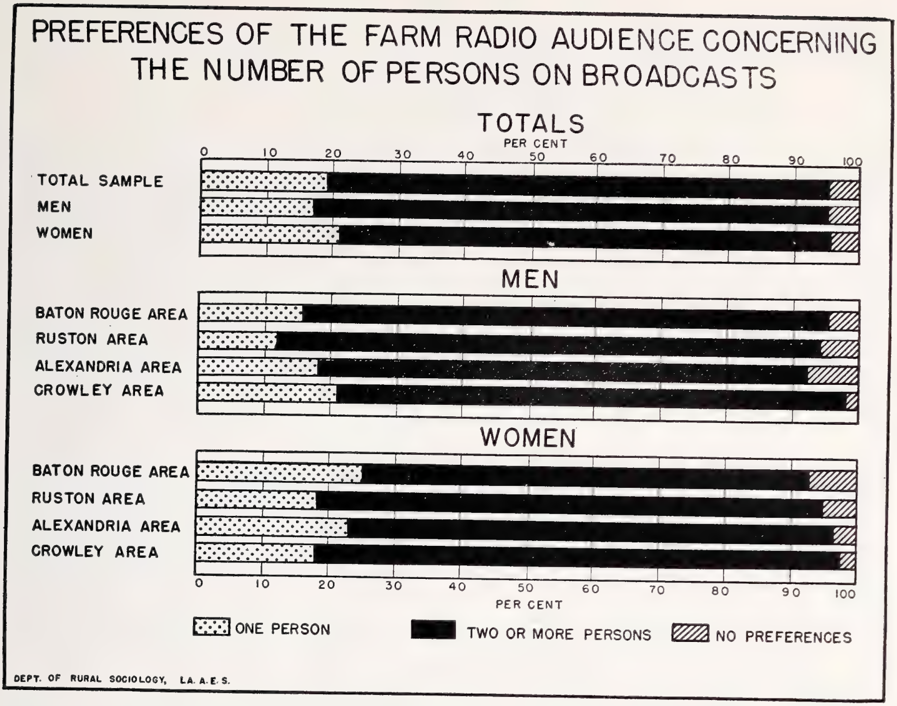


FIGURE 17.—Proportions of Farm Radio Audience Expressing Preferences Concerning Number of Persons on Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

two or more persons on broadcasts. Slightly less than one-fifth feel that one person does a better job. Sex differences in preferences regarding the number of persons on farm broadcasts are not pronounced. In this respect, women seem to be slightly more in favor of only one person than are men, although a majority of both sexes indicate a preference for two or more participants.

Area differences are not great. It is interesting, however, to note that proportionately more men from the Crowley area believe that one person succeeds in making programs more interesting than two or more persons, while just the opposite is true for the women of that area.

Broadcasts from the Farm

In their efforts to appeal to the farm audience, farm broadcasters have tried many different approaches. One of the most recent of these is the broadcast directly from the farm, in which farm people participate. In planning this study it was considered important to know the farm population's reception of this type of presentation as contrasted with the traditional studio farm program. Accordingly, the informants were asked to state their preferences for one of two kinds of programs: (1) a broadcast from the farm, with farmers participating; (2) a broadcast from a studio, with an Agricultural Extension specialist doing all the

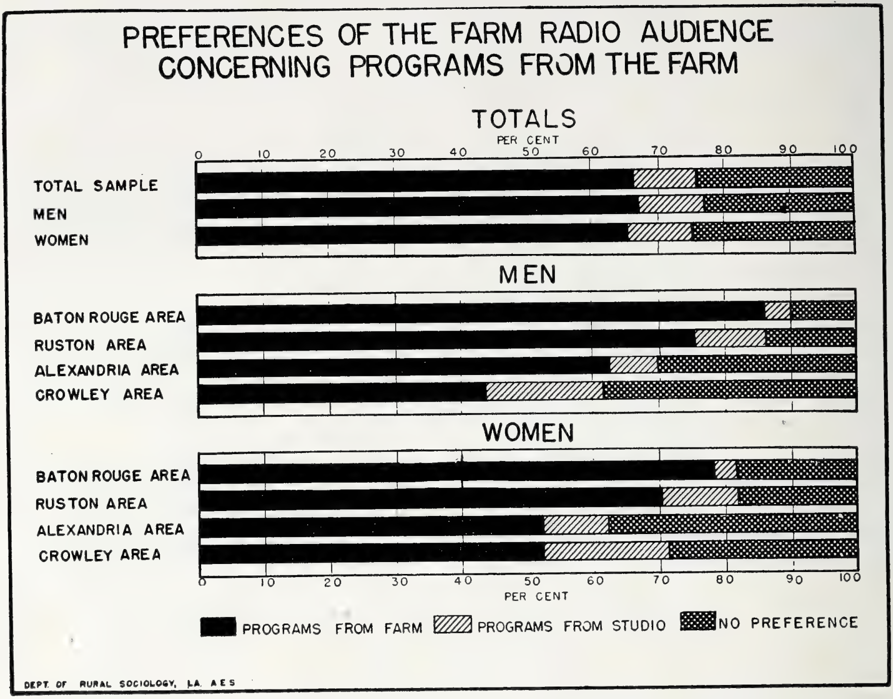


FIGURE 18.—Proportions of Farm Radio Audience Expressing Preferences Concerning Points of Origin of Farm Programs, by Sex, Four Farm Survey Areas, Louisiana, 1948.

talking (and presumably reading from a prepared script). Not all interviewees responded to this question, but the answers of those who did provide ample basis for drawing tentative conclusions. See Figure 18.

Two-thirds of all the interviewees express themselves in favor of programs emanating from the farm. In contrast, less than one-tenth of the informants indicate that they would rather hear an Extension expert do all the talking. The remaining one-fifth do not have any particular preference on this score.

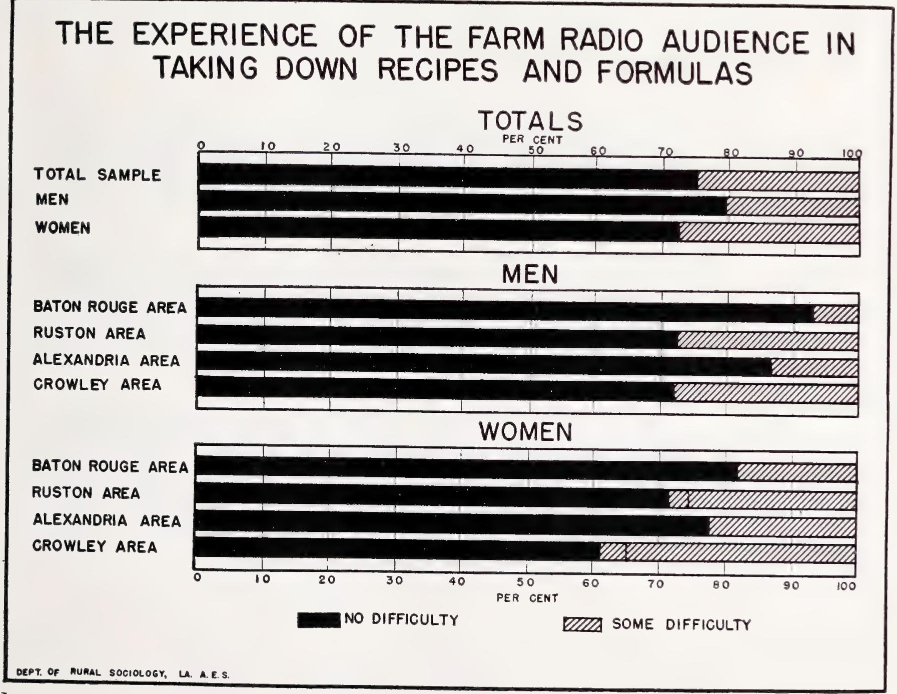
It is noteworthy that little difference appears in the proportions of men and women expressing preferences for programs from the farm or from the studio. As can be seen in Figure 18, about two-thirds of both men and women are in favor of programs from the farm. Only one out of every ten of each group has a preference for the type of program in which the Extension worker does all the talking. Proportionately fewer women than men do not have a definite preference for either of these particular ways of presenting programs.

Area comparisons bring out some interesting facts. Proportionately more of the farm people from the Baton Rouge area are in favor of broadcasts from the farm, and those from the Ruston area are second in this respect. A larger proportion of the interviewees from the Crowley area than from the other three areas prefers for Extension workers to do all the talking on a farm broadcast. The people from the Crowley area also stand out along with those from the Alexandria area as not having any particular preference in this regard.

Experiences in Taking Down Recipes and Formulas

The broadcasts of county and home demonstration agents, and other agricultural experts, often include some sort of a recipe or formula. In this respect it is important that the broadcaster regulate his rate of speaking so that listeners will have ample, but not superflous, time to write down the given information. In order to determine how well such programs are received, all interviewees were asked if they had had any difficulty in taking down recipes and/or formulas. Their answers were recorded categorically into three groups: those who had trouble, those who had no trouble, and those who had never tried to write down either a recipe or formula.

Of all the interviewees answering this question, more than three-fifths had made an attempt to copy a recipe and/or formula from a radio reading. The remaining persons state that they either never had the opportunity or never tried to take down such information. Among those who tried to take down recipes and/or formulas, as many as one-fourth report having experienced some difficulty doing so. See Figure 19. This proportion is perhaps large enough to warrant a deliberate effort on the part of those responsible for such broadcasts to avoid this pitfall.



DEPT. OF RURAL SOCIOLOGY, LA. A. E. S.

FIGURE 19.—Proportions of Farm Radio Audience Reporting Difficulty in Recording Recipes and Formulas, by Sex, Four Farm Survey Areas, Louisiana, 1948.

When the data for those who attempted to copy a formula or recipe are analyzed separately, it is found that proportionately more women experienced difficulty in writing down recipes than the men had taking down formulas.

Noteworthy differences exist among areas in the proportions of informants whose efforts at recording recipes or formulas met with difficulty. Neither the men nor the women in the Baton Rouge and Alexandria areas report as much difficulty in taking down such information as the men and the women in the Ruston and Crowley areas. The Baton Rouge area makes the most favorable showing in this respect.

Programs in the French Language

A considerable proportion of Louisiana's population speaks and understands French. Also present are smaller groups which are proficient in other foreign languages. For this reason it was deemed wise to include a question in the schedule concerning preferences for programs in a language other than English. As it turned out, except for one or two isolated cases, French was the only such language named.

Studies in the French sections of the state have indicated that the population is more receptive to information presented in that language.

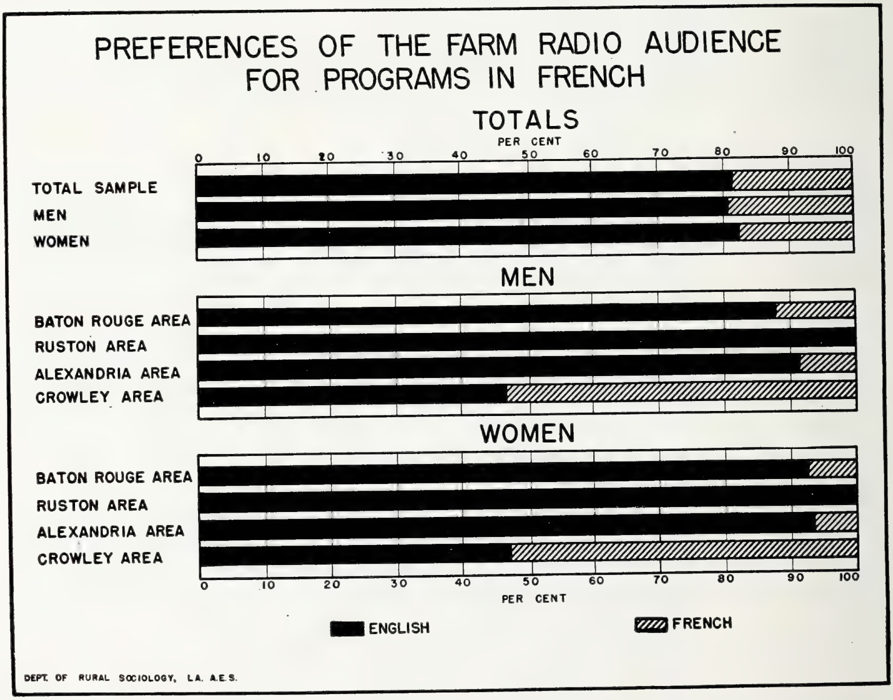


FIGURE 20.—Proportions of the Farm Radio Audience Expressing Preferences for French and English Broadcasts, by Sex, Four Farm Survey Areas, Louisiana, 1948.

In fact, some casual observers have gone so far as to say that any radio program in French, regardless of its nature, would be well received. This conjecture seems to be borne out by the findings of the present study, which are charted in Figure 20.

Almost one-fifth of the total number of interviewees state a preference for programs in French. This is a highly significant figure and one worthy of the attention of radio program planners. The findings are more useful, however, when considered from an area standpoint.

Although proportionately more men than women express a preference for programs in French, the difference is not significant. Area breakdowns show the picture more clearly. Relatively larger numbers of the men and the women in the Crowley area are in favor of such programs than is the case for the men and women in the other areas. In fact, well over one-half of all respondents in this area express a preference for programs in the French language. Such a preference is understandable, of course, in view of the fact that this area almost in its entirety is in the French section of South Louisiana. The county and home agents in these areas would further their work by an occasional broadcast in the French language. The Baton Rouge area ranks second and the Alexandria area third in the proportionate numbers of men and women expressing a preference for French broadcasts. The percentages of each, however, are nowhere near those in the Crowley area.

Ownership of and Intentions to Acquire FM-Equipped Radios

Frequency modulation is relatively new in commercial radio. Yet, almost every station has already entered or plans to enter this special field of broadcasting. This fact makes it important that the farmers be polled both as to the present ownership of FM sets and, if they do not already own one, their intentions as to acquiring such a set.

There is no doubt that FM broadcasting would have many advantages for rural groups. Not only would it overcome the problem of static in reception, but FM broadcasting conceivably could be used as a medium for beaming more programs directly to the rural audience. The regular broadcast bands could at the same time be kept free for programs of more widespread interest.

As can be seen in Figure 21, not many farmers now own FM sets. Of the interviewees, less than one in twenty say they possess a radio equipped for this type of reception. Area comparisons show that proportionately more of the farm people in the Baton Rouge area own FM-equipped radios than do those in the other three areas. No doubt the fact that WLSU (the Louisiana State University station) and other local stations have been so active in the FM field accounts at least in part for this relatively high degree of ownership. The persons in the Alexandria area have the second highest proportionate ownership of such sets, the Crowley area the third, and the Ruston area the lowest.

If we turn for the moment to the proportion of persons not owning such a set, but who indicate that they intend to acquire one, there seems

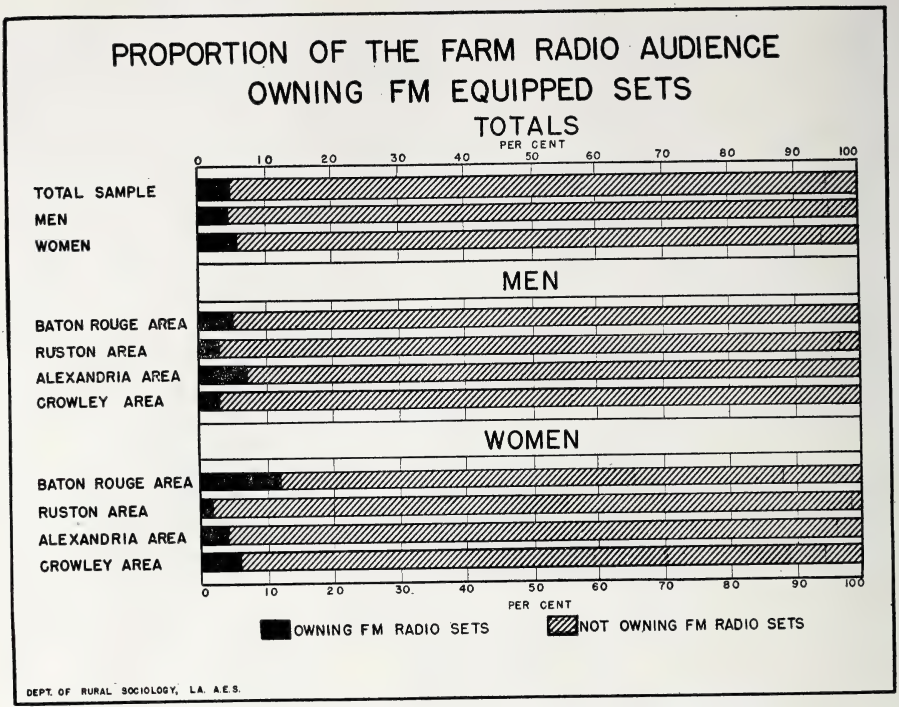


FIGURE 21.—Proportions of Farm Radio Audience Owning FM-Equipped Radios, by Sex, Four Farm Survey Areas, Louisiana, 1948.

to be more promise for FM farm broadcasting in the future. Over one-third of the group not owning such sets, as is shown in Figure 22, say they expect to get one. However, it is just as significant that an even larger group, almost two-fifths of all persons not owning sets, definitely have no intentions, at least for the time being, of spending extra money for FM equipped sets. What the remaining one-fourth will do, who are undecided about buying such a set, is problematical.

Apparently the men are more interested in FM programs. At any rate a considerably higher proportion of them state positively that they plan to acquire an FM set. The farmers in the Baton Rouge area lead all others in plans to buy such radios. The proportions planning to buy FM sets in the Ruston area (which ranked second) and the Alexandria area (which ranked third), however, are significant. The informants in the Crowley area not only own comparatively few such sets, but show relatively less interest in acquiring them.

Source of Local News

It was pointed out in Section II that one-third of the farm group who do not listen to broadcasts by their county and home agents claim that they do not do so because they have no way of knowing at what time the broadcast is scheduled. In anticipation of such a response, a question concerning sources of local news was included in the schedule.

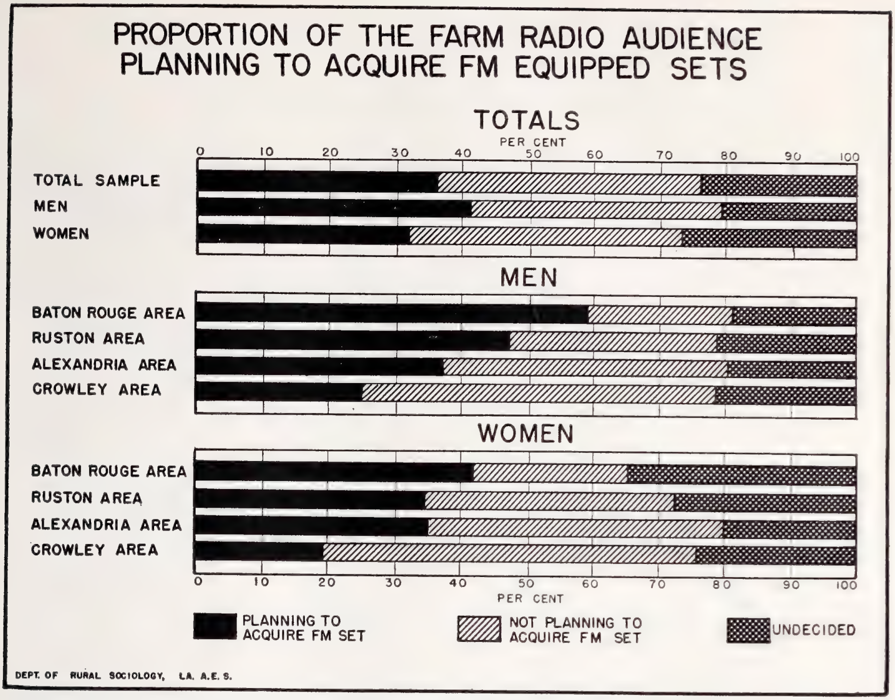


FIGURE 22.—Proportions of the Farm Radio Audience Expressing Intentions Concerning the Acquisition of FM-Equipped Radios, by Sex, Four Farm Survey Areas, Louisiana, 1948.

If the broadcaster familiarizes himself with the sources of local news among his audience, he can inform them as to the time of his broadcasts. The answers to this question were tabulated and appear in Figure 23.

Almost half of the interviewees depend solely on the radio for their local news. This is surprising information, and leaves little excuse for not informing them as to the time of farm broadcasts. Another one-sixteenth depend only upon their newspapers for news of local interest. Two-fifths of the informants rely on the newspaper and radio combined, while one-tenth receive local news only through conversations with their neighbors. Strange as it may seem, a few persons claim that they do not have any source of local news. From the above facts one conclusion of definite interest to the farm broadcaster stands out. If he will advertise his program schedule over the radio and in the local newspapers, the farm people will know when to tune him in. Figure 23, as would be expected, shows that the farm men and women have much the same sources of local news. Area differences in this respect are not pronounced. It does seem, however, that the farm people from the Alexandria area depend less on the radio alone and more on the radio and newspaper combined than do those from the other areas. Also, proportionately more Baton Rouge area interviewees rely solely on newspapers for local news than

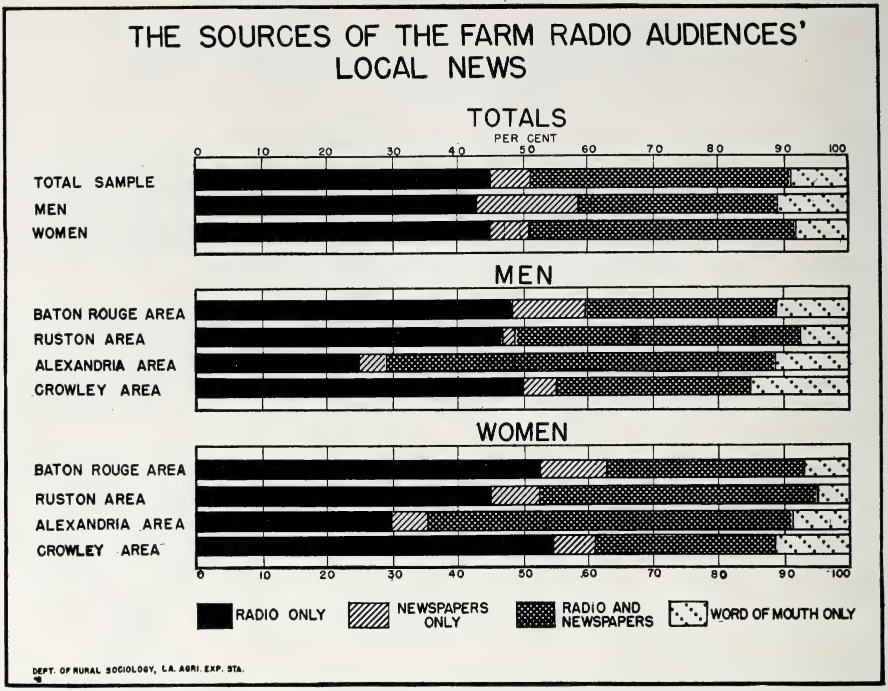


FIGURE 23.—Proportions of the Farm Radio Audience Possessing Specified Sources of Local News, by Sex, Four Farm Survey Areas, Louisiana, 1948.

do interviewees in the other three areas. Proportionately more farmers in the Crowley area do not report any source of local news.

VI. SUBJECTS FARMERS AND RURAL HOMEMAKERS WANT DISCUSSED ON FUTURE BROADCASTS

The agricultural broadcaster, unless he conducts a survey, has little way of knowing what his audience wants to hear in the way of specific information. Although he may have wide contacts and feel that consequently he can surmise the needs of this group accurately, the fact remains that without objective criteria he has no positive proof that his conjecture is correct. In order that the Extension worker might have some concrete basis for selecting his presentations, all interviewees were asked to list four subjects which they would like to hear the county or home demonstration agent discuss on a future broadcast. Although all did not list this many, almost all specified at least one topic. The topics named were tabulated and classified (with the help of Agricultural Extension specialists) under broad headings. See Table II and Figure 24. It was not deemed important to make sex breakdowns because county and home agents can readily determine in which of their broad fields of concentration a particular subject best fits. Area differences, however, are important, and these distinctions are maintained in the following analysis.

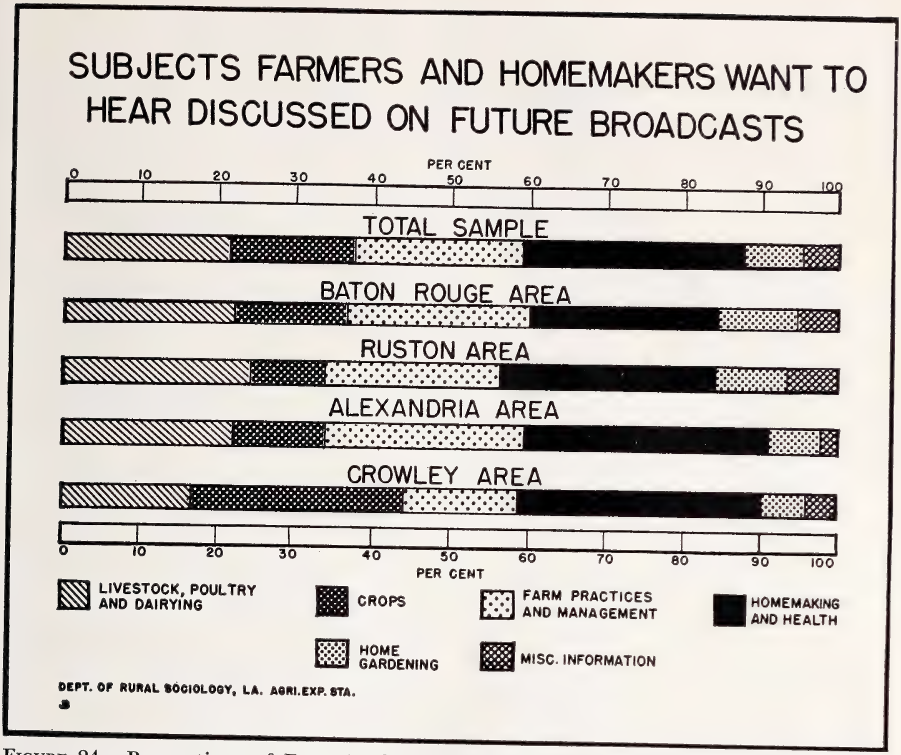


Figure 24.—Proportions of Farm Radio Audience Expressing Preferences for Specified Subjects on Future Farm Broadcasts, Four Farm Survey Areas, Louisiana, 1948.

Homemaking and Health

Subjects classifiable under the general category of homemaking and health are mentioned proportionately more often than are any other topics desired for future broadcasts. Included are requests for specific information on sanitation, canning and preserving, sewing, landscaping, general household hints, frozen foods, curing of meats, child care, and recipes and cooking. The reason, of course, for the popularity of this category of subjects is its appeal and interest to most of the women.

Close scrutiny of Table II shows that the specific subject under homemaking and health for which there are most requests is canning and preserving. This topic accounts for almost one-tenth of all requests. Recipes and cooking rank second within this general topic, followed closely by requests for programs on general household hints and sewing information, respectively. The other specific requests in order of their importance are as follows: child care, frozen foods, landscaping, sanitation, and curing of meats.

Area differences, while apparent for specific items, are not pronounced for this general category. It can be seen in Figure 24 that the interviewees from the Alexandria and Crowley areas proportionately more often request health and homemaking information. Proportionately fewest such requests are made in the Baton Rouge area.

TABLE II. PROPORTIONS OF FARM RADIO AUDIENCE EXPRESSING PREFERENCES FOR SPECIFIED SUBJECTS ON FUTURE FARM BROADCASTS, FOUR FARM SURVEY AREAS, LOUISIANA, 1948

Subject	Baton Rouge Area		Ruston Area		Alexandria Area		Crowley Area		Total	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
I. LIVESTOCK, POULTRY AND DAIRYING	147	22.3	182	24.5	128	21.8	124	18.5	581	21.8
General livestock	33	5.0	27	3.6	21	3.6	13	1.9	94	3.5
Veterinary advice	13	2.0	8	1.1	5	.9	5	.8	31	1.2
Breeding advice	2	.3	4	.5	4	.7	5	.8	15	.5
Cattle	15	2.3	25	3.4	33	5.6	39	5.8	112	4.2
Hogs	18	2.7	21	2.8	9	1.5	7	1.0	55	2.1
Poultry	61	9.3	79	10.6	47	8.0	52	7.7	239	9.0
Dairying	5	.8	18	2.4	9	1.5	3	.5	35	1.3
II. CROPS	95	14.4	71	9.5	73	12.3	177	26.2	416	15.7
Cotton	20	3.0	15	2.0	29	4.9	45	6.7	109	4.1
Cane	7	1.1	1	.1	0	.0	2	.3	10	.4
Potatoes	16	2.4	3	.4	2	.3	21	3.1	42	1.6
Corn	14	2.1	9	1.2	15	2.6	25	3.7	63	2.4
Rice	0	.0	0	.0	0	.0	71	10.5	71	2.7
Cover crops	0	.0	7	.9	0	.0	0	.0	7	.3
Feed crops	6	.9	6	.8	9	1.5	3	.4	24	.9
Horticulture	24	3.6	17	2.3	12	2.0	9	1.4	62	2.3
Orchards	8	1.2	13	1.8	6	1.0	1	.1	28	1.0
III. FARM PRACTICES AND MANAGEMENT	155	23.6	167	22.5	150	25.7	94	13.9	566	21.3
General	35	5.3	15	2.0	28	4.8	12	1.8	90	3.4
Pasture	13	2.0	14	1.9	25	4.3	8	1.2	60	2.3
Fertilizer	29	4.4	16	2.2	20	3.4	9	1.3	74	2.8
Ground preparation	6	.9	0	.0	0	.0	0	.0	6	.2
Planting	32	4.8	21	2.8	26	4.4	12	1.8	91	3.4
Conservation	3	.5	20	2.7	14	2.4	1	.1	38	1.4
Weed control	1	.2	2	.3	8	1.4	4	.6	15	.6
Irrigation	0	.0	12	1.6	2	.3	6	.9	20	.8
Drainage	0	.0	6	.8	4	.7	1	.1	11	.4
Insect and disease	33	5.0	57	7.7	22	3.8	37	5.5	149	5.6
Gov't policies and outlook	3	.5	4	.5	1	.2	4	.6	12	.4
IV. HOMEMAKING AND HEALTH	167	25.3	213	28.7	183	31.3	215	31.8	778	29.1
Sanitation	1	.2	2	.3	8	1.4	6	.9	17	.6
Canning and preserving	66	10.0	68	9.2	55	9.4	73	10.8	262	9.8
Sewing	17	2.5	27	3.6	27	4.6	34	5.0	105	3.9
Landscaping	6	.9	8	1.1	4	.7	4	.6	22	.8
Household(general)	35	5.3	48	6.5	30	5.1	35	5.2	148	5.6
Frozen foods	4	.6	3	.4	11	1.9	7	1.0	25	.9
Curing of meats	2	.3	6	.8	0	.0	0	.0	8	.3
Child care	5	.8	12	1.6	4	.7	15	2.2	36	1.4
Recipes and cooking	31	4.7	39	5.3	44	7.5	41	6.1	155	5.8
V. HOME GARDENING	59	8.9	63	8.5	39	6.7	38	5.6	199	7.5
VI. MISCELLANEOUS INFO.	36	5.5	47	6.3	13	2.2	27	4.0	123	4.6
Use and care of machinery	10	1.5	4	.5	2	.3	5	.7	21	.8
Rodent control	2	.3	7	.9	0	.0	1	.1	10	.4
Forestry mg'mt	1	.2	5	.7	0	.0	0	.0	6	.2
Local weather and market reports	23	3.5	31	4.2	11	1.9	21	3.2	86	3.2
VII. TOTAL	659	100.0	743	100.0	586	100.0	675	100.0	2,663	100.0

As far as individual items are concerned, the interviewees from all areas cite canning and preserving more often than any other. Recipes and cooking and household hints also hold positions of prominence in all areas, ranking no lower than third in any one. Sewing is fourth in all areas. The other items differ considerably in rank order from area to area. Further details regarding the degree of interest displayed in the several specific topics may be gleaned from Table II.

Livestock, Poultry, and Dairying

Ranking in second place and accounting for over one-fifth of the total number of subjects requested are topics dealing with livestock, poultry, and dairying. Specific sub-topics included under this general heading are: general livestock, veterinary advice, breeding advice, cattle, hogs, and poultry. The specific item which farmers name most often is poultry. Next in importance are cattle, following by livestock, hogs, and dairying, in that order. Veterinary advice is sixth and breeding advice last among the several choices specified.

More requests for information dealing with livestock, poultry, and dairying are received in the Ruston area than anywhere else. The fewest calls for this type of information come from the Crowley area. There are, however, no great differentials from one area to the next in this respect.

Farm Practices and Management

Not far behind livestock, poultry, and dairying as a general subject among the requests of the informants are farm practices and management. This broad heading also includes over one-fifth of all the requests named. Eleven sub-classifications are included under this title as follows: general, pasture, fertilizer, ground preparation, planting, conservation, weed control, irrigation, drainage, insect and disease control, and government policies and farm outlook.

More area differences appear with respect to this general subject than with the previous ones. The largest proportionate number of such requests are voiced by farmers in the Alexandria area. Considerable numbers of the interviewees in the Baton Rouge and Ruston areas, however, display interest in this category of programs. By way of contrast, the farmers in the Crowley area proportionately make barely half as many such requests as do the farmers from any one of the other areas.

Under the farm practices and management category, general information is the specific topic most sought after in the Baton Rouge area. Insect and disease information is second in this area, with planting and fertilizer third and fourth, respectively. In the Ruston area, discussions regarding insect and disease control are requested most often. Planting information is second in popularity as a broadcast topic in this area and conservation third. Fourth among preferences is information regarding fertilizer. The farm people in the Alexandria area want to hear general farming information more than any other specific topic in this category.

They, however, are also interested in planting information and pasture improvement information, as is indicated by the fact that they rank these items second and third, respectively, as subjects for broadcasts. Fourth among their requests is insect control and disease information, and fifth is ground preparation. In the Crowley area more informants are interested in insects and plant diseases than in any other topic under farm practices and management. General and planting information (with the same number of requests for each) follow, and are trailed by fertilizer and pasture information in that order.

Crops

Louisiana is a state of diversified crops. It is not unusual, therefore, that information on a large number of individual crops should be requested as specific broadcast subjects. The fact is that crops as a general category rank fourth among the subjects named by the interviewees. Among the individual crops concerning which information is desired are cotton, corn, potatoes, cane, rice, cover crops, feed crops, horticultural crops, and orchards.

It is interesting to note that proportionately more farm people desire crop information in the Crowley area than in any other. Proportionately the least interest in crop broadcasts is shown in the Ruston area. The breakdown by individual areas provides a more comprehensive picture of differences in requests for specific information on particular crops.

In the Baton Rouge area relatively more farmers request farm broadcasts concerning horticultural crops. The second largest proportionate number of requests in this area is for cotton information, the third for potatoes, and the fourth for corn. The crops most often mentioned in the Ruston area, as in the Baton Rouge area, are those which are classifiable under the general category of horticultural crops. Cotton is also second in this area. Orchards, however, are third. In fourth place is corn, and this is followed by cover crops, feed crops, potatoes, and sugar cane. The farmers in the Alexandria area express proportionately most interest in getting information regarding the growing of cotton. Their second choice is for programs dealing with corn. Horticultural crops rank next, followed by feed crops, orchards, and potatoes, in that order. In the Crowley area the crop by far most often mentioned as a program subject is rice. Cotton is next in importance, and is followed by corn. Ranking fourth in number of times specified is potatoes, and fifth, horticultural crops. Hardly mentioned are sugar cane, feed crops, and orchards.

Home Gardening

Generally recognized is the fact that gardening is a vital activity of the farm family. It yields a ready supply of fresh vegetables both for immediate consumption and for canning. That a considerable number of interviewees request that information on home gardens be broadcast is therefore not surprising. Area differences with respect to the number of requests for information on home gardens are not great. Proportionately more of the farm people in the Baton Rouge and Ruston areas, however, seem to want such information.

Miscellaneous Information

Some of the subjects asked for by the interviewees cannot be classified readily under any of the above general topics. These are grouped under the general title of "miscellaneous information." Included among these are requests for broadcasts on the use and care of machinery, rodent control, forestry management, and local weather reports.

The fact that more persons voluntarily ask for local market and weather reports than any of the other items is not surprising in view of the facts revealed in Section IV. It is interesting to note, however, that proportionately more of these requests come from the Ruston area. The fewest, on the other hand, are received in the Alexandria area. As can be seen in Table II, a considerable number of farmers are interested in the use and care of farm machinery. The Baton Rouge area leads the list in such interests and is followed by the Crowley area.

Rodent control is always a problem on farms. Perhaps the farmers in the Ruston area are more at a loss as to how to cope with rodents than are the farmers from the other three areas, or they have more of a problem in this respect than do those from the other areas. At any rate more requests for broadcasts dealing with this subject are made in that area.

Forestry management also seems to be of somewhat more interest to farm people in the Ruston than in the other areas. In fact, the farm people in the Baton Rouge area are the only other ones to manifest any interest at all in this subject.

TECHNOLOGY AND SCIENCE [illegible]

93b
d Set

Louisiana Bulletin No. 441 October 1949

PASTURE WORK AT THE NORTHEAST LOUISIANA EXPERIMENT STATION

St. Joseph, Louisiana

TECHNOLOGY AND SCIENCE ROOM

By

C. B. Haddon, *Superintendent*

UNIVERSITY OF MARY
R Y
MAR 27 1961

Louisiana State University
and
Agricultural and Mechanical College
Agricultural Experiment Stations
W. G. Taggart, *Director*

PASTURE WORK AT THE NORTHEAST LOUISIANA EXPERIMENT STATION

By C. B. Haddon, *Superintendent*

Introduction

The growing of beef cattle in the Louisiana Delta has been practiced by farmers in a limited way for a great many years. The advent of the boll weevil soon after the beginning of the present century stimulated beef production to a considerable extent, but two factors tended to discourage the practice: (1) the presence of the cattle tick and, (2) the discovery of means of controlling the boll weevil, which discovery caused farmers to turn again to cotton production. With the eradication of the cattle tick some farmers, especially large planters with considerable acreage not well adapted to cotton, went into beef production as a means of utilizing such land. When cotton acreage was limited in 1933 by the control program, more farmers turned to beef production on the acreage taken out of cotton. The outbreak of war in Europe in 1939 and the Defense Program instituted in this country caused a very serious shortage of farm labor, and this caused more farmers to turn to beef cattle and away from cotton.

Although the soils of the Louisiana Delta are well suited to the growing of pasture grasses and clovers, no systematic study of comparative values of pasture crops had been made until 1940. Fields grazed by cattle over a period of years became sodded with Bermuda grass and, in some sections, with white Dutch clover. The Legislature in 1940 made a special appropriation to the Experiment Stations of Louisiana State University for pasture study on alluvial land. Using this fund, pasture experiments were begun at the Northeast Louisiana Experiment Station at St. Joseph, Louisiana, in the spring of 1941. In the first years of the pasture studies the land and cattle were supplied by a commercial planting company, the planning and execution of the experiments being carried out by the Station. This arrangement was followed for four years. It was then deemed that it would be wiser for the Station to own the land and the cattle in order to have complete control. In 1945 approximately 125 acres of land were purchased by Louisiana State University for pasture studies, and a fund was made available for the purpose of purchasing the cattle. The land on which the pasture experiments have been conducted is a very heavy type of Sharkey clay (buckshot), poorly drained and entirely unsuited for cultivation. This land had been lying idle since the growing of rice in this section was discontinued, about 20 years prior to its purchase by the University.

Experimental Methods and Results

At the beginning of the pasture work in the spring of 1941 six 6-acre blocks were fenced off, four of which were broken, disked, harrowed, and small surface drains put in. These plots were numbered 1 to 6, and the following plantings were made: No. 1—Dallis grass and Kobe lespedeza; No. 2—Bermuda grass and Kobe lespedeza; No. 3—Dallis grass and Alyce clover; No. 4—Dallis grass, Bermuda grass, Kobe lespedeza, and Alyce clover; No. 5—drained and mowed only, not broken or planted; No. 6—no treatment. The above plantings were made in early April, the rate of seeding being that usually recommended for the various crops. Blocks 1 to 5 inclusive were clipped once in May and once in June to keep down growth of native weeds. On July 1 light grazing was begun on all blocks, the number of cattle used per block being varied from time to time according to the capacity of the pastures. Grazing was continued 2½ months, at which time cattle were removed and the following plantings made: No. 1—Persian clover and rye grass; No. 2—white Dutch clover and rye grass; No. 3—red clover and rye grass; No. 4—alsike clover and rye grass. No plantings were made on Nos. 5 and 6. The above plan of establishing the pastures was followed in order to allow the grasses to become well established before the winter clovers were planted.

Good stands of the clovers were obtained on the four planted plots, and grazing was begun March 23, 1942, at which time the clovers planted the previous fall had made considerable growth. Ten head of 2-year-old steers were grazed on each of plots 1 to 4 inclusive. Four head of similar age steers were used on block 5, and three head on block 6, as it was seen that these last two blocks would not carry greater numbers. On May 18 all of the steers were sold, and no other cattle were available for use on the pastures until June 6, twenty days of peak grazing thus being lost. On June 7 twelve head of yearlings were put on each of the planted pastures; six head of similar cattle were placed on plot 5, and four head on plot 6. These were grazed until October 8, at which time all the cattle were removed from the pastures. The beef production per acre in this, the first full season of grazing, was as follows: No. 1—355 lbs.; No. 2—298 lbs.; No. 3—338 lbs.; No. 4—353 lbs.; No. 5—152 lbs.; No. 6—91 lbs.

In 1943 grazing was begun March 10 and continued to October 15, plots 1 to 4 inclusive carrying ten head of 2-year-old steers, plot 5 six head, and plot 6 four head of similar animals. The yield of beef per acre was as follows: No. 1—423 lbs.; No. 2—446 lbs.; No. 3—508 lbs.; No. 4—292 lbs.; No. 5—217 lbs.; No. 6—153 lbs. The 1944 grazing and results were about equal to those in 1943.

By 1945 the red clover on block 3 and the alsike clover on block 4 had become very scant, owing to continuous grazing in the seeding period during the previous years. In March of this year these two plots were seeded to Kobe lespedeza, the seed being sown broadcast on the grass sod without seedbed preparation. Excellent stands of lespedeza were obtained from this seeding. The Persian clover on plot 1, and the white Dutch clover on plot 2 had reseeded well and had excellent stands. During this year a system of rotational grazing was used. On March 19 twenty-four head of 2-year-old steers (four head per acre) were weighed and turned on plot 1. On March 28 the cattle were weighed out and turned on plot 2. This rotation was continued at 10- to 14-day intervals on these two plots until June 18, at which time the cattle were weighed and turned on plot 3. The rotation system was continued on plots 3 and 4 until September 17. After the cattle were removed from plots 1 and 2, the grasses made excellent growth. Two cuttings of hay were made on block 1, August 9 and September 1, and one cutting of hay was made on block 2, August 9. Following the cutting of hay the grasses put out new growth and cattle were put back on these two blocks and the rotational system used, as in spring.

The results of the above system were as follows: beef production on plot 1, including spring and fall grazing, was 251 lbs. per acre; beef production on plot 2 was 443 lbs. per acre; the average for the two plots was 347 lbs. per acre. Plot 1 yielded 2034 lbs., and plot 2 yielded 1474 lbs. of cured hay per acre. The beef production on plots 3 and 4 averaged 212 lbs. per acre. The lespedeza in these two pastures suffered considerable damage on June 12-13, when they were flooded by a 7.29-inch rainfall. Under the system used this year, the pastures carried one animal per acre for the entire season, producing 280 lbs. of beef per acre, and sufficient hay was saved to carry the cattle through the following winter.

About the close of the 1945 grazing season the land on which the pasture work had been carried on was bought by Louisiana State University, as mentioned above. No use was made of the pastures in 1946, owing to the fact that the fences were being moved, the pasture plots enlarged, and a unified drainage system, supervised by the Soil Conservation Service, put in. In the fall of this year reseedings of red and alsike clovers were made on plots 3 and 4.

As stated above, the pastures were enlarged during 1946, two acres being added to each plot, making them eight acres each. In the fall of 1946 the added acres in plots 1 to 4 inclusive were seeded to the same clovers and grasses as the original plots had been. No seedings were made on plots 5 and 6. No cattle were put on the pastures until June 28, 1947, because of inability to obtain fencing. On the above date eight head of yearling steers were put on each of plots 1 to 4 inclusive, five head on plot 5, and three on plot 6. Grazing on all plots was continued until October 9. During this 103-day period the following gains per acre were made: No. 1—190 lbs.; No. 2—163 lbs.; No. 3—172 lbs.; No. 4—156 lbs.; No. 5—109 lbs.; No. 6—59 lbs. In 1948, grazing was begun March 2 and continued to October 16, plots 1 to 4 inclusive each carrying nine head of 2-year-old steers, plot 5 six head, and plot 6 four head. The gains per acre were as follows: No. 1—409 lbs.; No. 2—484 lbs.; No. 3—513 lbs.; No. 4—507 lbs.; No. 5—367 lbs.; No. 6—158 lbs.

The 6-year average production of beef per acre has been as follows: No. 1—342 lbs.; No. 2—380 lbs.; No. 3—375 lbs.; No. 4—302 lbs.; No. 5—212 lbs.; No. 6—132 lbs. Leaving out 1947, when pastures were grazed only 103 days, the 5-year average production of beef per acre on the four planted pastures has been as follows: No. 1—372 lbs.; No. 2—423 lbs.; No. 3—416 lbs.; No. 4—328 lbs.

From the above it will be seen that practically 400 lbs. of beef per acre have been produced annually on land totally unsuited for cultivation. While it is true the price for beef during these years has been unusually high, the return per acre, even with moderate prices, would have been very profitable. The pastures have been clipped as necessary, usually not more than once per season, and a light seeding of rye grass is made on the grass sod each fall.

Discussion of Results

Of the two grasses used it has been found that Dallis is superior to Bermuda. The Dallis grass is less susceptible to injury from late summer heat and drought, retaining its palatability even under severe conditions. In addition to the above features, Dallis begins growth in the spring earlier than Bermuda and continues much later in the fall and early winter, thus giving a longer grazing period. Of the four clovers used, it has been found that, if stands are good, red clover will give the best gains. It is necessary, however, to reseed red clover at least every other year, as it does not produce sufficient seed under heavy grazing to insure reseeding. Alsike clover has not proved to be as good as either red or white Dutch. It also requires reseeding every other year, and it has been observed that the reseeding of this clover on well-established sod has not been as successful as with the other clovers. Persian clover has maintained itself quite successfully and is somewhat earlier than the other varieties. The criticism of this clover is that it makes a very dense growth in spring, thus retarding the growth of Dallis and Bermuda grasses. Another criticism of Persian clover is that it seeds somewhat early, after which time it affords no grazing until the next crop comes on. White Dutch clover has proved to be probably the best all-round clover for this section. It begins growth fairly early in the spring, continues rather far into summer, and reseeds well under heavy grazing. For best pasture results on the type of soil used in these experiments, the best combination would be white Dutch clover, rye grass, and Dallis grass.

In setting up this experiment, as stated in the beginning, pasture No. 5 received no preparation other than drainage. It has been clipped two or three times each season. The object in this procedure was to determine how long it would take nature to develop a good pasture. In 1948 this pasture gave almost as good return as the seeded pastures. In the spring of 1949 this pasture is apparently well sodded with Bermuda and Dallis grasses and carries an excellent stand of white Dutch clover. It might be pointed out, however, that it has taken seven years for this condition to be brought about. In the meantime, pastures 1 to 4 inclusive have produced an average of 138 lbs. more beef per acre annually than pasture No. 5, or a total of 828 lbs. more per acre for the six years. Even at very low prices for beef this increased production would have more than paid for proper preparation and seeding of the pasture.

Small Grain and Clover Grazing and Seed Test

In the fall of 1941 a combination grazing and clover seed test was begun, using four varieties of clover and four of the small grains. The soil and the conditions were the same as those described in the pasture test above. Four 4-acre blocks were fenced off and broken, disked, harrowed, drained, and planted as follows: Block 1—Persian clover and wheat; Block 2—white Dutch clover and barley; Block 3—red clover and oats; Block 4—alsike clover and rye.

All plantings were made about the middle of October. Grazing was begun March 3, six head of grade mixed yearlings being used on each block. The cattle were grazed until April 24, at which time the grain crops were practically gone. Cattle were then removed, and the clovers allowed to produce a seed crop. The results of this test are given in Table 1.

TABLE 1. Results of Grazing and Seed Test with Small Grains and Clovers, 1942*

		Beef Gains (lbs.)		Clover Seed (lbs.)	
BLOCK		Total	Per acre	Total	Per acre
No. 1	(Persian clover & wheat	245	61	130	32.5
No. 2	(white Dutch clover & barley)	325	81	233	58.0
**No. 3	(red clover & oats)	480	120	672	168.0
No. 4	(alsike clover & rye)	395	99	418	104.5

* Six head of cattle were grazed on each 4-acre block from March 3 to April 24, 1942.

** 1900 pounds of hay per acre were cut on block 3 on May 25.

The clover seed were harvested with combine. Soon after the clover seed were harvested from block 1, the land was disked and seeded to Sudan grass for late summer and fall grazing. On the other three blocks grazing was continued soon after the clover seed were harvested. Owing to the fact that the cattle used for the late summer grazing consisted of very wild calves, it was not possible to obtain accurate weights to determine the gains made. It might be said, however, that excellent gains were obtained, especially from block 1, Sudan grass, where 14 head of calves were grazed for a period of three months.

In October of 1942 these pasture blocks were disked and reseeded to grains as above. The results the second year are given in Table 2.

TABLE 2. Results of Grazing and Seed Test with Small Grains and Clovers, 1943*

		Beef Gains (lbs.)		Clover Seed (lbs.)	
BLOCK		Total	Per acre	Total	Per acre
No. 1	(Persian clover & wheat)	308	77	386	96.5
No. 2	(white Dutch clover & barley)	408	102	312	78.0
**No. 3	(red clover & oats)	462	115	346	86.5
No. 4	(alsike clover & rye)	266	66.5	318	79.5

* Grazed from March 3 to April 24, 1943.

** 1620 pounds of clover hay per acre were produced on block 3.

Based on the results obtained from this test, it is evident that there is an excellent opportunity for the farmer to obtain a profitable revenue from this type of land, hitherto considered waste, by using a combined beef and clover seed harvest operation.

Wintering Experiment

In the fall of 1947 a tract of land consisting of 20 acres was cleared of undergrowth, weeds, and briars, and planted to oats and vetch to be used in a wintering experiment. This land was a very heavy Sharkey clay (buckshot) and very poorly drained. Before planting, a number of small open drains were put in. Oats were planted at the rate of 3 bushels and vetch at the rate of 40 lbs. per acre. Plantings were made in early September. The tract was divided into two sections of 10 acres each, and on December 19 ten head of 2-year-old steers were turned on each section. On January 13 the steers on block 1 were put on the following feed: 3 lbs. corn, cob, and shuck meal, and 1 lb. of cottonseed pellets per head per day. Steers on block 2 received no feed except some hay during a short period in January when the ground was covered with snow. Fifty days later, March 3, steers were taken off of both plots, weighed and turned on spring pastures, two steers of each group being turned on five different types of pasture. The steers which had been fed were in very good condition, having lost practically no weight during the winter, while the steers that were not fed had lost some weight but were still in good thrifty condition. All the steers were sold on May 28, weighing practically the same, and brought the same price. From March 3 to May 28 the steers which had been fed made a total gain of 2290 lbs.; the steers which had not been fed made a total gain of 2865 lbs. for the same period. During the 50-day feeding period the fed steers consumed a total of 150 lbs. of corn, cob, and shuck meal, and 50 lbs. of cottonseed pellets each.

In the fall of 1948 this test was repeated on the same plan as outlined above. Because of the very mild winter, the period of winter grazing was considerably shorter, the steers being turned on the pastures December 14 and taken off February 25. During this period, the fed steers consumed 78 lbs. of corn, cob, and shuck meal, and 26 lbs. of cottonseed pellets each. The steers were turned on spring pastures February 25 and divided as in the previous year. All the steers were sold May 27 and brought the same price. The fed steers had made a total gain of 2465 lbs., and the steers not fed, 2880 lbs.

While this work has been carried on only two years, it would appear from the results that it is not profitable to feed stocker steers through the winter, if grazing sufficient to keep them in good thrifty condition is available. Another conclusion from this test is that stocker cattle can be wintered without feed on oats and vetch, even on the heaviest buckshot type land. In preparing the seedbed for oats and vetch, the land was not deeply broken, the only preparation being done with disks, which were run three times over the ground. This type of seedbed preparation prevented the cattle from bogging deeply when the ground was wet.

TECHNOLOGY AND SCIENCE ROOM

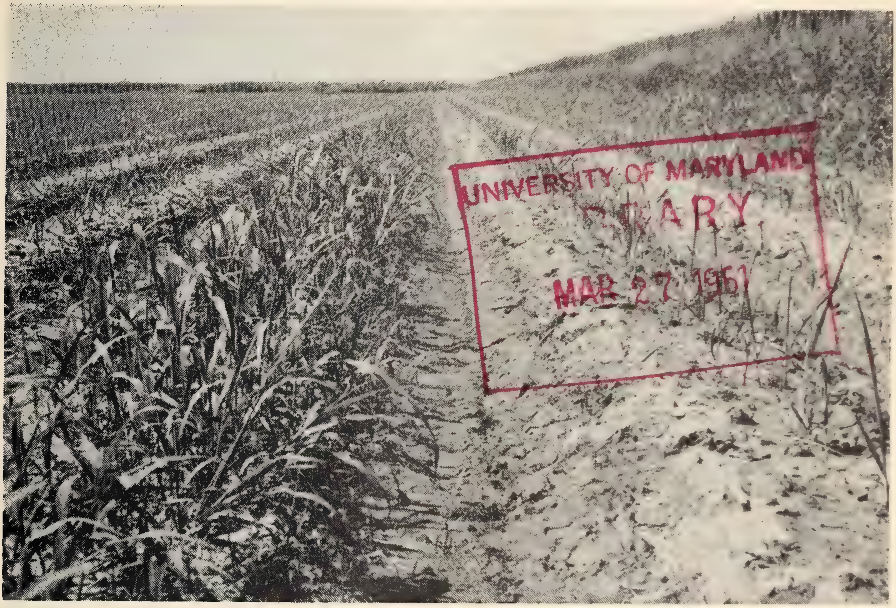
93b
S1

Louisiana Bulletin No. 442 April, 1950

The Control of Johnson Grass in Sugarcane Fields

By

E. R. STAMPER AND S. J. P. CHILTON



UNIVERSITY OF MARYLAND
LIBRARY
MAR 27 1951

Johnson grass seedling control in summer plant cane. Untreated row on left, control program on right.

[illegible] ASSISTANCE ROOM

LOUISIANA STATE UNIVERSITY
and
AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

ACKNOWLEDGMENTS

Acknowledgment is made to the following companies for generosity in furnishing chemicals for the experimental program on which these recommendations are based: American Chemical Paint Co., Ambler, Pa.; Chapman Chemical Co., Memphis, Tenn.; Chipman Chemical Co., Inc., Bound Brook, N. J.; Commercial Solvents Corporation, Terre Haute, Ind.; Dow Chemical Co., Midland, Mich.; E. I. DuPont de Nemours & Co., Wilmington, Del.; John Powell & Co., Inc., New York, N. Y.; Lion Oil Co., El Dorado, Ark.; Niagara Chemical Division, Middleport, N. Y.; Sharples Chemicals, Inc., Philadelphia, Pa.; Shell Chemical Corporation, San Francisco, Calif.; and Standard Oil Development Co., Elizabeth, N. J.

The Control of Johnson Grass in Sugarcane Fields

E. R. STAMPER AND S. J. P. CHILTON

Johnson grass infestations in the sugarcane fields of Louisiana have become a very serious problem in the last few years. It is estimated that at least 100,000 acres of land devoted to sugarcane have become so thoroughly infested that some sort of program such as fallow plowing should be practiced to reduce Johnson grass to a level low enough for a good plant cane crop. Approximately 50,000 acres are so badly infested with Johnson grass seed that reinfestation by seedlings eliminates the effectiveness of a fallow plowing program. Often at the end of the crop cycle, Johnson grass is about as bad as it was before the fallow plowing program was begun. Many more acres of land, while not badly infested, have ditchbanks and headlands covered with Johnson grass.

In 1947, studies were begun by the Louisiana Agricultural Experiment Station to obtain the information necessary for a control program. These have dealt with the populations of Johnson grass seed over the sugarcane belt, the effect of fallow plowing and mowing on the eradication of large plants and their rhizomes, a search for chemicals safe to use in sugarcane fields and suitable for killing both Johnson grass seedlings and large plants, and the combination of these chemicals with certain cultural practices. As information accumulated, it was published (1, 2, 3, 4) so that it would be of immediate value to those who were starting control practices. Further studies will be published as completed.

While much further work needs to be done, it is possible to make certain recommendations based on large-scale tests made in 1949. Figure 1 shows a plot of plant cane where Johnson grass was controlled and one where it was not controlled.

This bulletin gives a summary of the control methods which have been proven safe. It is highly probable that as the work progresses, better chemicals and methods will be found, and the recommended methods will be changed However, the Johnson grass problem has become sufficiently acute in certain areas that control measures should be put into practice as soon as possible.

Eradication of Large Plants

At present fallow plowing, or continuous plowing in the year sugarcane is not grown, is the cheapest and surest method available for the elimination of large Johnson grass plants and their rhizomes. Approximately 6-11 plowings are necessary for adequate control, and costs are estimated at $12 to $16 per acre.

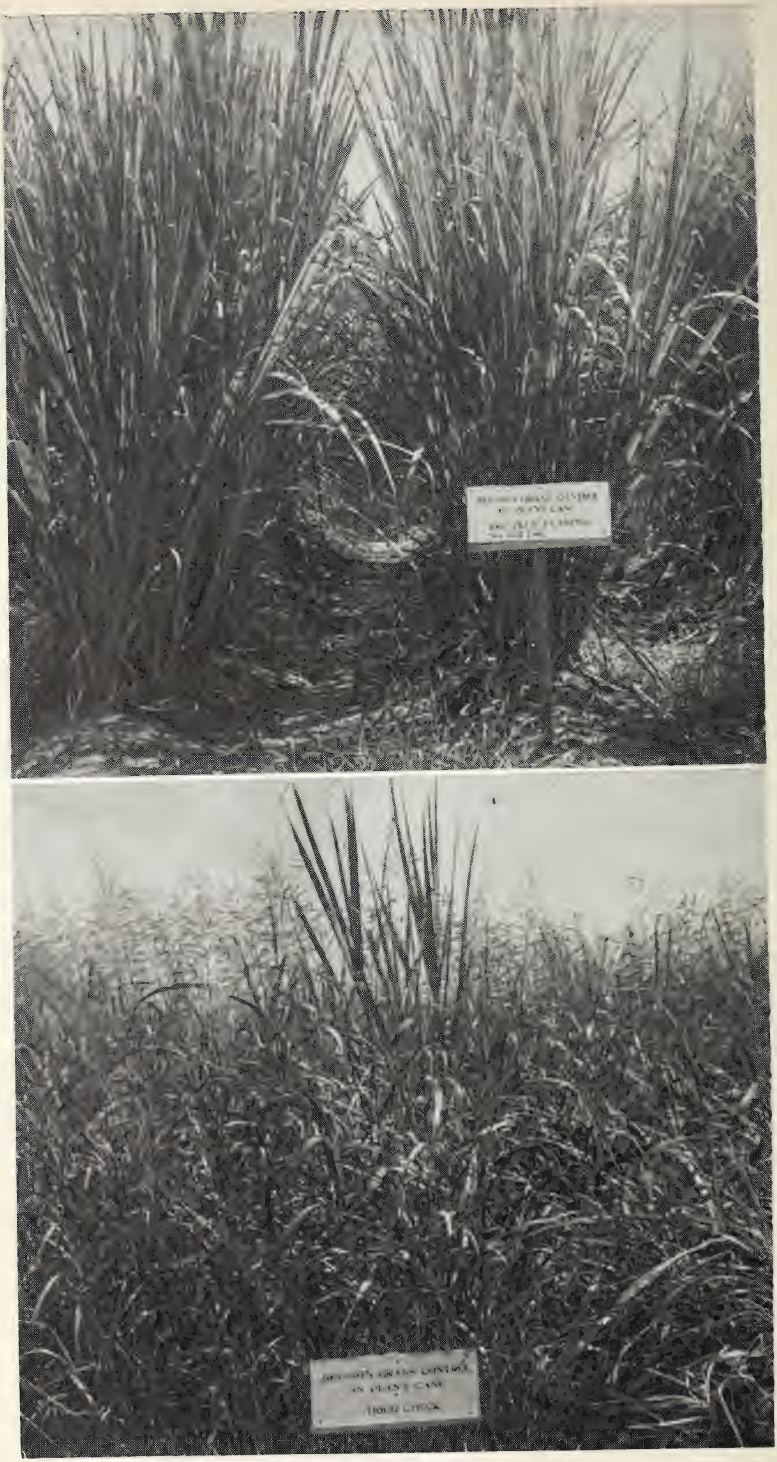


Figure 1.—Johnson grass seedling control in plant cane. Above: Plant cane in August after a control program of 2,4-D plus flaming. Below: Hoed check.

Under certain conditions a crop of corn and beans can be raised and after the corn is harvested, sufficient plowings made to kill nearly all Johnson grass rhizomes. However, large amounts of Johnson grass seed are produced in the corn and bean crop (2) so that seedling reinfestations reach levels where none of the control practices is adequate. For this reason, it is felt that this is not a good practice in areas where Johnson grass seed are produced.

Observations have shown that in many fallow plowing programs the Johnson grass rhizomes are not destroyed in the ditchbank rows. This is due to not plowing sufficiently close to the ditchbanks or not plowing this area as often as the remainder of the field. As a result, when the outside rows are made up they are full of rhizomes which have been brought in from the ditchbanks or which have not been destroyed by the plowing. Care should be taken that the ditchbank be kept as narrow as possible and this area and the ditchbank row be plowed more often than the rest of the field.

Where Johnson grass seed are not present in the soil, fallow plowing should clean up a field. It may be desirable to rogue or spot treat with chemicals to eradicate the plants which have escaped the fallow plowing.

Seedling Control

The control of Johnson grass seedlings is essential on many plantations. Without a program dealing with this phase, the effect of the fallow plowing is in great part lost after the plant cane crop is raised.

Certain terms have come into use with chemical sprays, and for clarity these are defined as used in this bulletin.

Pre-emergence spray: A pre-emergence spray is one applied before weed seedlings have appeared above the ground.

Post-emergence spray: This type spray is applied after the weed seed have germinated and the seedlings can be seen above the ground.

A drill spray is one in which the spray is confined to a band over the row or drill in the immediate area where the cane is growing. It may be any width but is usually 24 to 36 inches wide. It may be applied either as a pre-emergence or a post-emergence spray.

Blanket spray: This spray covers the entire surface of the field, including the drills, sides and middles of the rows.

Acid equivalent: The herbicidal activity of 2,4-D is based on its acid content. Because the straight acid is relatively insoluble in water, the 2,4-D is sold as the amine salt (liquid), the sodium salt (dry powder), and as the ester (liquid). Companies sell these materials at various strengths. In order to reduce these differences to a standard, all 2,4-D materials are sold with the per cent strength in terms of 2,4-D acid given on the label. In addition the pounds of 2,4-D acid per gallon is given for the amine salt and the ester. In this way it is possible to calculate the amount of a commercial product necessary to supply a given rate of 2,4-D acid per acre.

The following recommendations are given for the control of Johnson grass seedlings. These are for use in fields where rhizomes have been destroyed by fallow plowing and reinfestation from seedlings occurs.

Plant Cane

Fall Treatments

In fields planted before October 1, use a roller or cultipacker of some sort so that the surface of the row is packed smooth.

Apply a pre-emergence drill spray of 2,4-D at the rate of 2 pounds acid equivalent per acre. This spray should cover a band at least 30 inches and preferably 36 inches wide. The actual amount of chemical used per acre would be from 13 ounces to 1 pound depending on the width sprayed. The spray should be applied before the Johnson grass seedlings come up. This treatment will ordinarily be 60-90 per cent efficient, but sufficient seedlings will usually be left to require further control methods. It has been found that a flame cultivation two or three weeks later will kill most of the seedlings that have escaped the 2,4-D treatment. If this is not sufficient, another flaming a week to 10 days later will be of value. It is advisable, if seedlings have begun to appear early, to give another 2,4-D spray after the flame cultivation.

Where a flame cultivator is not available a mixture of 2,4-D (2 pounds acid equivalent per acre) and 6 gallons of an 8-10 per cent pentachlorophenol in oil per acre should be applied as a drill spray before the seedlings that have escaped the initial 2,4-D spray get over 3 inches high. The amount of the pentachlorophenol actually used would be 3 gallons per acre for a drill spray 36 inches wide.

The sides and middles of the row should be cultivated as needed to eliminate the seedlings that are present. Care must be taken that the cultivation overlaps the sprayed area so that there will not be a row of seedlings which have not been destroyed either by the chemical treatment or the cultivation.

One roguing should be made to remove plants from rhizomes not killed by the fallow plowing and from seedlings that have escaped the control program.

Late Planted Sugarcane

Sugarcane planted after October 1 usually does not have many seedlings. A roguing to remove plants coming from rhizomes is of value.

Spring Treatments

Spray the drill with 2,4-D at the rate of 2 pounds acid equivalent per acre as soon as the cane is shaved, or shaved and off-barred, but before the seedlings appear. A flame cultivation should be made two to three weeks later or before the Johnson grass seedlings produce roots.

Another drill spray of 2,4-D should be applied whenever the soil in the drill is disturbed. If flame cultivation is not used, pentachlorophenol plus 2,4-D at the same rate as in the fall should be applied. Care must be taken in the cultivation operations that a row of seedlings is not left between the treated drill and the cultivated area.

Immediately after the layby cultivation a blanket spray of 2,4-D at 2 pounds acid equivalent per acre should be applied.

A roguing should be made before rhizomes are produced by the seedlings that remain.

The approximate cost of the above programs in the fall and spring are estimated as follows:

2,4-D and flaming, including chemicals, application, flaming and roguing—$9 to $11 per acre.

2,4-D and pentachlorophenol, including chemicals, application and roguing—$11 to $13.50 an acre.

Where pre-emergence sprays have not been used, good results have been obtained where a spray of 2,4-D was applied and a flame cultivation made one week later. Where necessary another flame cultivation one week after the first one has increased the efficiency of control still further. This method has worked with seedlings 3 to 5 inches tall.

Stubble Cane

It has been observed that if plant cane is kept free of Johnson grass, the first stubble will start out clean. If it is desired to kill the Johnson grass plants that have escaped the control program in plant cane, two chemicals are available for spot treatment. These are sodium chlorate plus calcium chloride as a safener, and sodium or ammonium trichloroacetate (TCA). Amounts that gave good results in 1949 are (1) two pounds of sodium chlorate plus one pound of calcium chloride per gallon of water, and (2) one pound of 100 per cent equivalent TCA per gallon of water. The mixture should be sprayed on the Johnson grass plants when they are large enough to stand out from the sugarcane, which will usually be by the time they first head. The sodium chlorate mixture is cheaper but the trichloroacetates are less harmful to the cane and soil in the treated areas. The strengths of the chemical solutions given are too great for use except for spot treatment of stools in a field.

It is probable that a 2,4-D application on the drill following shaving, a flame cultivation or a pentachlorophenol plus 2,4-D application before the seedlings get too tall, and a layby blanket spray of 2,4-D would be of sufficient value in preventing further infestations by Johnson grass seedlings and controlling other weeds to justify their use in stubble cane.

Sodium chlorate in badly infested stubble cane was tried in 1949. Results were very erratic, and further studies are necessary before recommendations for its use can be made.

Ditchbanks and Headlands

The eradication of Johnson grass on ditchbanks and headlands will be of value when a control program has been started in the fields and it is seen that it will work.

At present sodium chlorate is the cheapest chemical for use on a large scale. Experiments indicate an application of at least 600 pounds of sodium chlorate (Figure 3) per square acre is necessary for good kill of the Johnson grass rhizomes, although 450 pounds per acre has worked in many cases. Best results seem to be obtained if the chemical is applied when the Johnson grass has headed. It should be applied in 400-450 gallons of water per acre.

Sodium chlorate is inflammable when it dries and is in contact with organic matter. Calcium chloride should always be added to the sodium chlorate at the rate of ½ pound of calcium chloride to 1 pound of sodium chlorate. It should not be sprayed around wooden buildings, and operators on the sprayers should wash their clothes at the end of each day to remove the sodium chlorate. Otherwise, they might catch fire.

The cost per acre for the sodium chlorate-calcium chloride mixture at 11c per pound for the first chemical and 3c per pound for the second one is about $75. Translated into ditchbank area, the chemicals needed for a ditch 8 feet wide would cost $72.80 a mile, or $2.90 a running acre. If close fallow plowing is practiced and the ditchbank is narrowed to 6 feet, the cost for chemicals would be approximately $54.50 a mile, or $2.20 a running acre.

If properly applied, spot treatment to kill missed plants should not be more than a sixth of the original cost.

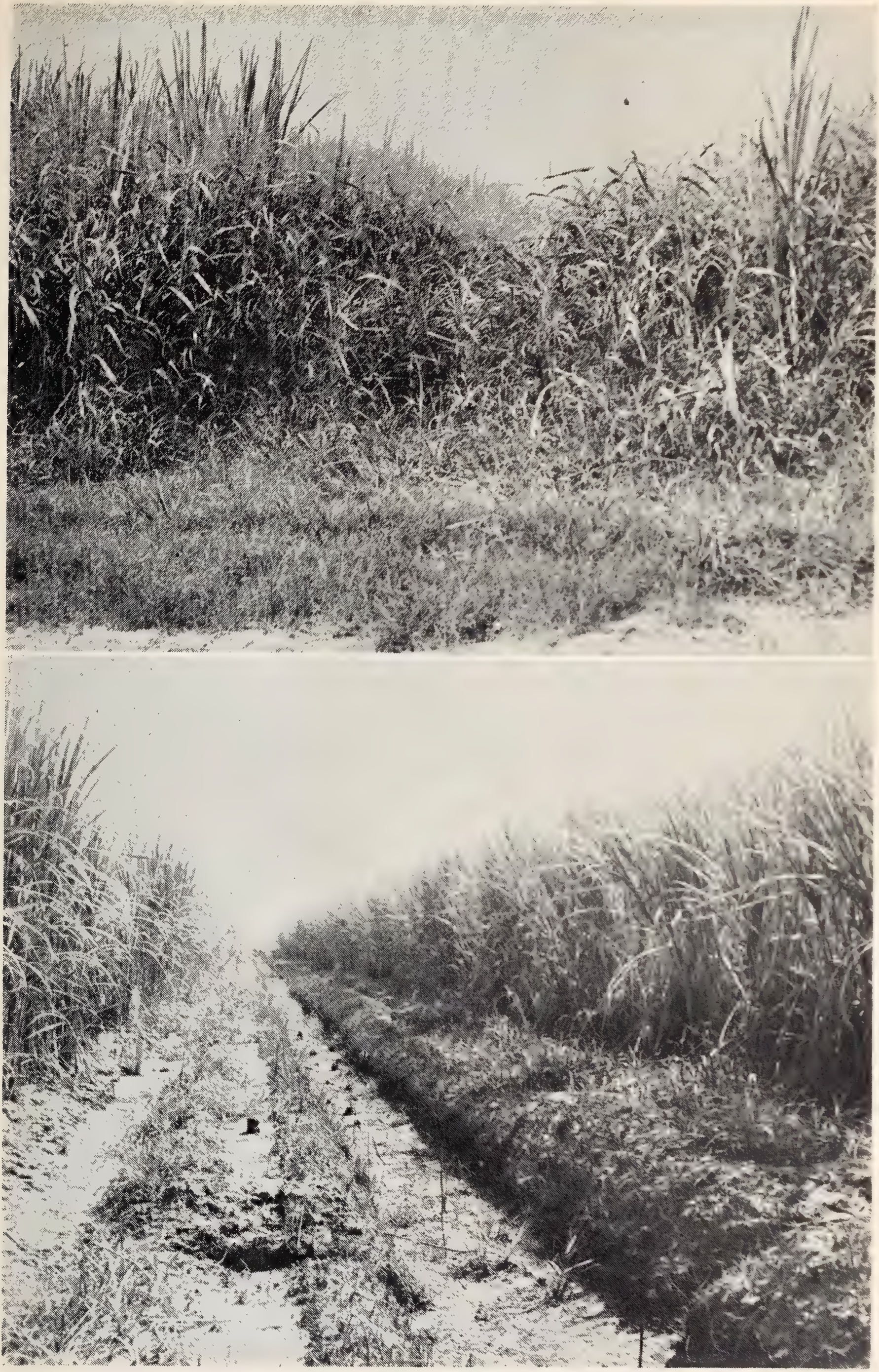


Figure 3.—Johnson grass control on ditchbanks. Above: Infested ditchbank before treatment. Below: Six months after treatment with sodium chlorate at 600 pounds per acre.

The natural flora which comes in after the Johnson grass is killed should not be mowed for at least one full year after application of the chemicals. This will prevent seed from germinating in the soil as the sodium chlorate leaches down.

Chemicals are expensive and where they are used, the areas to be treated should be reduced to the minimum by close and continual plowing.

Sprayers

There are a number of sprayers on the market which can be used in cane fields. Some come with wheels and others can be carried in cane carts. Three rows seem to be the maximum that can be sprayed efficiently at one time.

Sprayers to be selected depend on whether they are to be used in the cane fields or on the ditchbanks, or for both purposes, since the amount of water used per acre is different. It has been found that as little as a half gallon of water per acre can be used to apply 2,4-D, but the less water used, the greater difficulty there is in getting even application of the chemical. For applying 2,4-D, or pentachlorophenol plus 2,4-D, a sprayer should be large enough to apply 40 to 100 gallons per acre as a blanket spray. This amounts to 20 to 50 gallons per acre for a 36-inch drill spray. The fan type nozzle, which produces a fan-shaped spray pattern, seems to give better results than the cone type nozzle, from which the spray emerges as a hollow cone.

One 3-row sprayer can cover from 20 to 40 acres a day. Sufficient spraying equipment should be available to keep up with the shaving and off-barring operations, since a difference of 4 to 5 days in spraying may make considerable difference in the control obtained.

If ditchbanks are to be sprayed, it will be necessary to have a pump capacity on the sprayer capable of putting out 400-450 gallons of water per acre, and the tank should be large enough that it will not have to be refilled too often. Spray nozzles will have to be larger than those used to spray the fields. Sodium chlorate and the trichloroacetates are very corrosive and all sprayers should be washed out each evening after these materials are used.

When a sprayer is first purchased it is necessary to determine how much chemical to add to each tank of water. The simplest method is to fill the tank and spray a known area of land with the nozzles to be used and at the desired speed. Determine the amount of water used by filling the tank again, and calculate the amount of water sprayed per acre. Add enough chemical to give the rate desired per acre to each tank of water. For example, if a sprayer holds 200 gallons and sprays 40 gallons of water per acre as a blanket spray, 10 pounds acid equivalent of 2,4-D should be added to each tank of water. Two hundred gallons (tank capacity) ÷ 40 gallons (sprayed per acre) = 5 acres x 2 pounds acid equivalent (rate 2,4-D per acre) = 10 pounds 2,4-D acid equivalent per tank of water. Once this is determined, the sprayer can be used for blanket or drill spraying by closing or removing nozzles. Pressures in the line must be watched and kept the same as originally used for the calibration.

Most of the amine salts of 2,4-D are 40 per cent acid equivalent and carry 4 pounds of 2,4-D acid equivalent per gallon and 1 quart equals 1 pound acid equivalent of 2,4-D. The sodium salt is sold in varying strengths and Table 1 gives the amounts necessary for 2 pounds acid equivalent per acre.

Precautions should be taken with all chemicals. 2,4-D in particular should not be sprayed near gardens and valuable broadleaf plants. Sodium chlorate should not be sprayed around wooden buildings.

Table 1. Amount of product of the sodium salt of 2,4-D to be used to give 2 pounds acid equivalent per acre as a blanket spray

Acid equivalent sodium salt of 2,4-D % acid	Amount of product per acre	
	Lbs.	Ozs.
50	4	0
55	3	10
60	3	5
65	3	1
70	2	14
75	2	11
80	2	8
85	2	6

☆ ☆ ☆

LITERATURE CITED

1. Chilton, S. J. P. Johnson grass control. Sugar Bull. 27 (10): 149. 1949.
2. Phillips, R. P., and S. J. P. Chilton. Studies on Johnson grass seed populations in the sugarcane areas of Louisiana. Sugar Jour. 12 (1): 3-5, 13-14. 1949.
3. Stamper, E. R., and S. J. P. Chilton. Weed control in sugarcane. Sugar Bull. 28 (4). 54, 57-59. 1949.
4. Stamper, E. R., E. S. Hagood, H. T. Barr, and S. J. P. Chilton. 2,4-D and Johnson grass seedlings. Sugar Bull. 27 (9): 129, 137. 1949.

[illegible] AND [illegible] ROOM

Louisiana Bulletin No. 443 June, 1950

MILK MARKETING IN THE NORTH LOUISIANA UPLAND COTTON AREA

By

William H. Alexander

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
MAR 27 1961

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. Taggart, *Director*
The United States Department of Agriculture
Bureau of Agricultural Economics
Cooperating

TABLE OF CONTENTS

Page
Introduction 4
Method and Scope of Study 5
Description of the Area and Markets 6
  Type of Farming 6
  Cows Milked Per 100 Population 8
  Occupation of Employed Male Workers 8
Volume and Source of Milk Supply 10
Prices Received by Farmer for Milk 10
Utilization of Milk Supply 15
Seasonal Variation in Milk Production 15
Per Capita Consumption of Milk 21
Increased Per Capita Consumption 23
Summary and Conclusion 26

LIST OF TABLES

Table Page
I The Average Number of Cows Milked Per 100 Acres of Cropland Harvested in the Upland Cotton Area During 1945 7
II Number of Cows Milked Per 100 Population in the Upland Cotton Area During 1945 8
III The Occupation of Employed Male Workers, by Parishes of the Upland Cotton Area, During 1940 9
IV The Average Number of Quarts of Milk Delivered per Day by Producer-Distributors and Processor-Distributors During 1946 11
V The Volume of Milk Handled by Producer-Distributors and Processor-Distributors in the Upland Cotton Area During 1946 13
VI The Variation in the Number of Wholesale Milk Producers, the Amount of Milk Produced, and the Price Received per Hundredweight of Milk by Dairy Farmers in the Upland Cotton Area During 1946 14
VII The Utilization of the Total Milk Supply by Processor-Distributors in the Upland Cotton Area During 1946 16
VIII Seasonal Variation in the Amount of Milk Received from Local Wholesale Producers by Processor-Distributors in the Upland Cotton Area During 1946 17
IX A Comparison of the Amount of Milk Consumed per Capita in the Upland Cotton Area and the United States During 1946 22

LIST OF FIGURES

Figure Page

I The Upland Cotton Area of North Louisiana 5

II The Amount of Milk Produced and Sold by Farmers in the Upland Cotton Area and the Amount of Whole Milk Purchased by Dealers from Other Regions during 1946 13

III The Source of the Total Supply of Milk Distributed to Consumers in Urban Areas of the Upland Cotton Area During 1946 20

IV The Average Number of Producers Who Sold Milk at Wholesale in the Upland Cotton Area During 1946, the Number of Additional Producers Needed if all Milk Distributed Had Been Produced Locally, and the Number of Producers Needed if the Per Capita Consumption were 75 and 100 Per Cent of the Per Capita Consumption in the United States 24

V The Total Volume of Wholesale Milk Produced by Farmers in the Upland Cotton Area during 1946, the Amount of Milk Distributed, and the Amount of Milk Which Would Have Been Sold if the Per Capita Consumption in the Area Were 75 and 100 Per Cent of the Average Per Capita Consumption in the United States 25

Acknowledgement

The writer wishes to express his appreciation for the assistance received from the following individuals and organizations: To Professor B. M. Gile of the Department of Agricultural Economics, who read the manuscript and made many valuable suggestions in preparing this report; to Mr. Frank D. Barlow, Jr., formerly of the Louisiana Agricultural Experiment Station, and Mr. Robert B. Glasgow and Mr. Lee Langsford of the Bureau of Agricultural Economics, who assisted in planning the study; to the processor- and producer-distributors for their cooperation and assistance which made this study possible.

MILK MARKETING IN THE NORTH LOUISIANA UPLAND COTTON AREA

William H. Alexander

Introduction

The production and marketing of milk and dairy products is of vital interest to many farmers in the Upland Cotton Area of Louisiana. The area consists of the following eight parishes: Bienville, Claiborne, DeSoto, Jackson, Lincoln, Sabine, Union, and Webster (Figure I). The number of farmers producing milk for sale and the amount of milk sold have increased considerably since 1940. This change to greater emphasis on the dairy enterprise took place rapidly during World War II and is still under way. The economic forces tending to increase the importance of dairying in the area include the following: (1) an increase in the amount of available cropland for producing feed resulting from the reduction of acres in cotton under the farm price support program of the 1930's and the outlook for future controls; (2) the increased effective demand and higher prices for milk and dairy products; (3) the adaptation of agricultural resources in the area to the production of hay and pasture crops makes the shift to dairying possible; (4) the amount of whole milk and cream consumed in the area is greater than local production during nine months of the year; and (5) the amount of milk, cream and other dairy products shipped into the area from other regions is considerably greater than it was in 1940.

The Upland Cotton Area is characterized by family farm units with cotton as the main source of cash income. Although cotton is declining in importance it is still the major cash enterprise for the area as a whole. The area has relatively low cotton yields per acre as compared to areas having alluvial soils. The alluvial area is better adapted to mechanization and therefore has a comparative advantage in the production of cotton. Moreover, there are fewer alternative opportunities for the utilization of resources in the Upland Area. The farmers in the Upland Area have a low investment in operating equipment and machinery for cotton production, and therefore would not incur significant capital losses in shifting to the dairy enterprise.

When the price for fluid milk increased, many farmers went into the production of milk even though the price for cotton increased at the same time. This fact has focused the attention of farmers upon the merits of dairying as an alternative source of cash income in the Upland Cotton Area and has resulted in a widespread demand for information with regard to the management of dairy farms, ways for improving the milk marketing system, and the probable future demands for fresh milk in the area. In order to determine the extent to which the dairy enterprise in the area might be profitably expanded it is necessary to

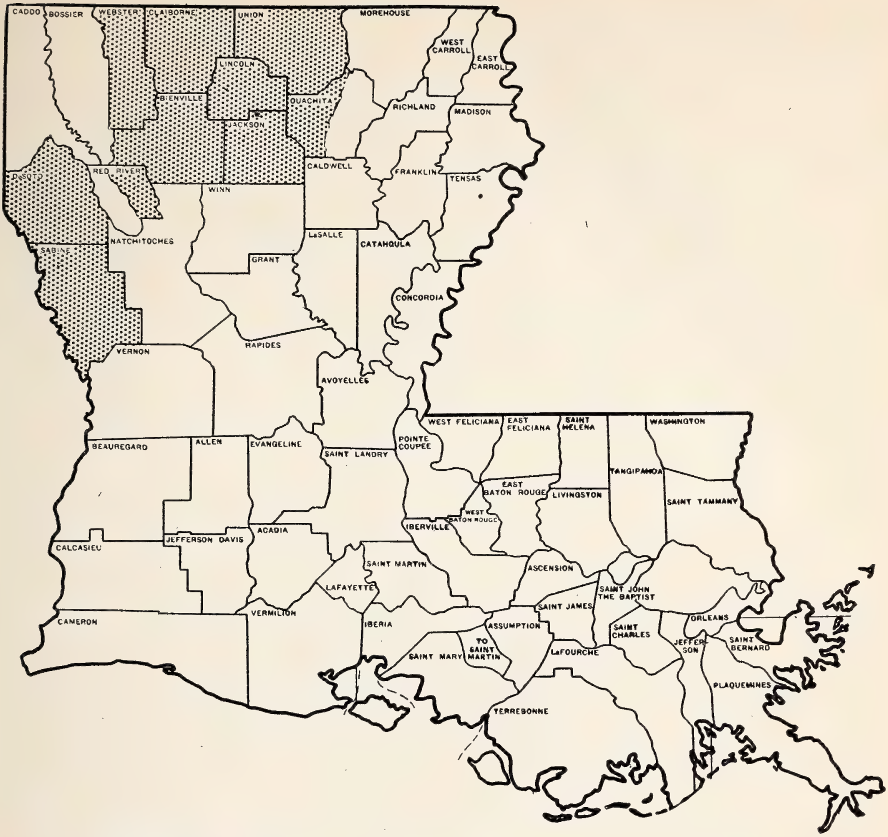


Figure I. The Upland Cotton Area of North Louisiana.

analyze the potential demand for fluid milk and other milk products.

This report presents information on the sources and utilization of milk and cream marketed in the area during 1946. Data are also presented on the seasonal pattern of production and price of local and out-of-area milk. An analysis is made of the per capita consumption of milk as well as the outlook for increased per capita consumption in relation to the possibilities for an expansion of the dairy enterprise in the Upland Area. Persons interested in an economic analysis of the production phase of the dairy problem are referred to the published report indicated below.[1]

Method and Scope of Study

Information regarding the number of wholesale milk producers, method of delivery, butterfat tests, prices paid for milk and volume of milk bought each month during 1946 from local producers, and the amount of milk purchased from other regions was obtained.

---

[1] Frank D. Barlow, Jr., and Morris L. McGough, *Dairy Farming in the North Louisiana Upland Cotton Area — Organization, Costs, and Returns,* Department of Agricultural Economics, Louisiana State University Agricultural Experiment Station Bulletin No. 435, Baton Rouge, La.

Data were also obtained from producer-distributors regarding the volume of milk produced and sold by them each month during 1946. In cases where producer-distributors purchased milk from wholesale milk producers the volume indicated is the total of their production plus that which they purchased.

Where the milk purchased from other regions was not whole milk, but was used for blending milk for fluid consumption, the volumes were converted to a 3.5 per cent milk equivalent. The amount of condensed cream and skim milk purchased from other regions by processor-distributors and used in the manufacture of buttermilk, butter and ice cream is indicated by the volume of sales of these products, because this is the only source of milk used for these purposes. The information was obtained by personal visit to the processor-distributor plants in the North Louisiana Upland Cotton Area.

All processor-distributors and producer-distributors who handled milk in cities of more than 2,000 population in the eight parishes in the Upland Cotton Area during 1946 were included in the study; therefore, the information presented in this report represents the total supply of milk to urban consumers. However, no attempt has been made to estimate the amount of milk produced and distributed by urban producers who kept a cow in their back yard. Supplemental information was obtained from the Parish Health Units, the Production and Marketing Administration, feed dealers, and others interested in the production and distribution of milk.

Description of the Area and Markets

Type of Farming

The predominant soils in the Upland Cotton Area are red clay and sandy loam with sand and clay as the chief sub-soil components. The topography is rolling and hilly. The average rainfall for the area is 49.13 inches annually, with December and January being the months of greatest and June the month of lowest precipitation. Droughts sometime occur during the summer season and are hazardous to crops and pastures. Cotton is the major source of cash farm income, and corn, oats, and sweet potatoes are other field crops. Dairying and beef cattle production have increased considerably in the last decade and now rank second as a source of farm income for the area as a whole. However, in DeSoto parish the dairy enterprise ranks first as the source of farm income. On many farms in the area the cash income is from a combination of cotton and the dairy enterprise, or cotton and other livestock enterprises.

The relative intensity of dairying as compared with crop enterprises is indicated in Table I. During 1945 there was an average of 5 cows milked per 100 acres of cropland harvested in the Upland Cotton Area. There was an average of 21 cows milked per 100 acres of corn harvested, and 22 cows milked per 100 acres of cotton harvested during

Table 1. The Average Number of Cows Milked Per 100 Acres of Cropland Harvested in the Upland Cotton Area During 1945[1]

Parish	Acres of cropland harvested	Average number of cows milked per 100 acres						
		Cropland	Corn	Cotton	Hay*	Sweet Potatoes	Irish Potatoes	Oats
Bienville	114,686	3	14	16	319	329	666	410
Claiborne	147,793	4	20	18	1,167	938	583	761
DeSoto	107,468	6	32	25	257	485	1,539	1,269
Jackson	38,487	6	21	32	310	276	257	-
Lincoln	106,225	4	22	19	361	672	537	2,851
Sabine	60,618	6	31	64	199	428	403	7,960
Union	87,623	5	16	20	548	225	239	2,656
Webster	82,065	4	18	19	283	395	1,444	316
Average		5	21	22	348	415	594	881

*Includes clover, timothy, lespedeza, small grains, other tame hay, and wild hay.

[1] Source: United States Census of Agriculture, United States Department of Commerce, 1945.

the same period. One of the major weak points of the dairy enterprise in the area is indicated in Table I, which shows that more than 3 dairy cows were milked for each acre of hay[1] harvested during 1945.

Cows Milked Per 100 Population

There was an average of 16 cows milked per 100 population in the Upland Cotton Area during 1945 (Table II). The number of cows per 100 population ranged from 8 in Webster Parish to 20 in Claiborne, DeSoto and Union Parishes. However, the eight parishes shown in Table II are the major milk producing parishes for the Shreveport, Monroe and El Dorado Market Areas,[2] all of which are located in parishes adjoining the producing area.

Occupation of Employed Male Workers

The type of employment of the major occupation groups in the market area studied gives an indication of the intensity of farming as compared with urban or nonfarm employment. Farming is the most important single occupation in Bienville, Claiborne, DeSoto, Lincoln, Sabine, and Union Parishes. The percentage of male workers employed as farm operators and laborers in these parishes ranges from 41 to 59 per cent of the total employed population (Table III).

The greatest percentage of male workers in Jackson and Webster Parishes are employed as craftsmen and other service workers. The major industry in these parishes is paper manufacturing, with large factories located at Hodge and Springhill. Producer-distributors in these towns reported that there was not enough milk produced locally to justify building adequate plant facilities for processing the supply of

Table II. Number of Cows Milked per 100 Population in the Upland Cotton Area During 1945

Parish	Population	Cows Mliked	Cows milked per 100 Population
	Number	Number	Number
Bienville	22,900	3,511	15
Claiborne	28,900	5,833	20
DeSoto	29,900	6,156	21
Jackson	17,100	2,234	13
Lincoln	23,900	4,333	18
Sabine	23,900	3,582	15
Union	21,100	4,383	21
Webster	39,200	3,393	9
Total or Average	206,900	23,425	16

---

[1] Includes clover, timothy, lespedeza, small grains, other tame hay, and wild hay.

[2] The term "Market Area" means milk markets within the eight parishes and nearby cities which receive their supply of milk from producers in the area.

Table III. The Occupation of Employed Male Workers, by Parishes of the Upland Cotton Area, During 1940[1]

Parish	Professional and semi-professional	Farm operators and farm laborers	Nonfarm proprietors, managers, clerical, & sales	Craftsmen and other service workers	Unpaid family farm workers	Other laborers	Total
				Percentage of Male Workers			
Bienville	4.3	50.8	8.0	14.8	11.3	10.8	100.0%
Claiborne	3.8	48.1	3.1	21.3	14.8	3.9	100.0%
DeSoto	3.1	48.2	7.3	15.5	19.2	6.7	100.0%
Jackson	4.4	28.2	10.5	32.2	7.0	17.7	100.0%
Lincoln	7.3	41.4	12.0	24.4	7.0	7.9	100.0%
Sabine	5.6	43.0	8.5	22.3	9.4	11.2	100.0%
Union	4.5	59.2	7.2	13.8	7.9	7.4	100.0%
Webster	4.8	29.2	12.4	36.6	6.8	10.2	100.0%
Area Average	4.3	37.2	11.9	28.2	8.7	9.2	100.0%

---

[1] United States Census of Agriculture, Bureau of Census, Volume 1, 1945.

milk needed by local consumers. They also report that currently the demand for fluid milk in these towns greatly exceeds the supply.

Volume and Source of Milk Supply

There was an average of 240 dairy farmers in the Upland Cotton Area who produced and sold milk at wholesale to processor-distributors in the area. The number of producers ranged from 217 during January to 256 during September (Table VI). The average annual production per dairy farmer in the area was 142,559 pounds, or an average of 11,880 pounds per month. The monthly production per farmer ranged from 7,885 pounds in November to 16,087 pounds in June.

There were six processor-distributors in the Upland Cotton Area during 1946 who purchased and processed all the fluid milk they distributed. Two of these were located in Monroe, Louisiana, three in Shreveport, Louisiana, and one in El Dorado, Arkansas. This type of distributor represented about 15 per cent of the total number of milk distributors, but they delivered about 82 per cent of the total supply of milk to consumers in the market area during 1946. Processor-distributors delivered an average of 8,813 quarts of milk daily during 1946, (Table IV), all of which was pasteurized.

There were 41 producer-distributors in the Upland Cotton Area during 1946. Thirty-three of these produced all of their milk supply from their own herds, with the exception of small purchases from other distributors during the winter months when their supply was short. Eight of the producer-distributors purchased a part of their supply from other dairy farmers in addition to production on their own farms.

The average number of quarts of milk delivered per day by producer-distributors was 287 and ranged from 257 quarts in February to 319 quarts per day in June. Less than half of the producer-distributors were pasteurizing milk during 1946; however, three-fourths of the milk delivered by this group was pasteurized. Producer-distributors who were pasteurizing delivered a greater volume of milk daily than those who were not pasteurizing.

Processor and producer-distributors in the Upland Cotton Area delivered approximately 51 million pounds of milk to consumers during 1946. The six processor-distributors handled 42 million pounds, or 82 per cent of the total supply, and the producer-distributors handled 9 million pounds, or 18 per cent of the supply (Table V).

The average amount of milk delivered by each processor-distributor during 1946 was 7 million pounds, and the average for each producer-distributor was one-quarter million pounds. Sixty-six per cent of the milk was produced by local wholesale producers, 18 per cent by producer-distributors, and 16 per cent was purchased from distributors in other regions.

Prices Received by Farmers for Milk

During 1946 the weighted average price received by local wholesale milk producers in the Upland Cotton Area was $4.53 per hundred-

Table IV. The Average Number of Quarts of Milk Delivered per Day by Producer-Distributors and Processor-Distributors During 1946

Market Area	Producer-Distributors			Processor-Distributors			Upland Area Total		
	Number	Quarts Per Day	Per cent of Total	Number	Quarts Per Day	Per cent of Total	Producer	Quarts Per Day	Per cent of Total
Monroe-El Dorado	16	256	23	3	4,681	77	19	18,139	100
Shreveport	5	488	6	3	12,945	94	8	41,285	100
Ruston-Arcadia	8	249	100	0	0	0	8	1,992	100
Minden	4	187	50	2[1]	748	50[2]	6	2,244	100
Homer-Haynesville	5	398	100	0	0	0	5	1,990	100
Springhill	3	174	40	2[1]	522	60[2]	5	1,566	100
Area	41	287	18	6	8,813	82	......	....	....

[1] Processor-distributors from the Shreveport Market Area also delivered milk in these cities during 1946.
[2] Estimated.

weight of milk containing 4 per cent butterfat. The price ranged from about $3.90 during the first six months to $5.75 during December (Table VI). The lower prices during the first six months were due in part to government price controls. The prices indicated in Table VI are weighted average prices for milk containing 4 per cent butterfat, and therefore do not represent the actual prices received by farmers because of the difference in individual butterfat tests and the differentials used by various dealers for milk containing higher or lower than 4 per cent butterfat. The price paid for milk, as indicated in Table VI, does not include subsidy payments, which ranged from 70 cents per hundredweight during the first four months of 1946 to 55 cents during May and June.

With the exception of the period of time that the price of milk was controlled by OPA, there has usually been a variation in the price paid for milk during winter and summer. During the first six months of 1946 price controls on milk were still in effect; therefore, in addition to the price per hundredweight as shown in Table VI, the farmers were receiving a subsidy payment from the government. The amount of the payment varied from 70 cents per hundredweight during the first four months to 55 cents during May and June. Following the removal of price control on June 30, 1946, the price of milk in the Upland Cotton Area increased from $3.91 in June to $4.78 in July, and continued to increase until the end of the year. The increase in price was more than off-set by the decrease in production; therefore, the farmer's monthly receipts from the sale of milk were less during the winter months.

The price of milk purchased in other regions, as indicated in Table VI, is the net cost of 100 pounds of milk to the processor-distributor. It includes the price paid to distributors and transportation cost. Processor-distributors in the Upland Cotton Area purchased milk in several Middle Western cities during 1946; therefore the transportation costs would vary with the location of the seller, but the average transportation cost was approximately $2.29 per 100 pounds of milk. As a result, the processor-distributors were unable to bring milk in from other regions as cheaply as they could buy it from local producers. The weighted average annual price for milk purchased in the Middle Western market was $6.85 per 100 pounds of 4 per cent milk during 1946.

Four per cent milk purchased from Middle Western markets cost local distributors approximately $2.32 more per 100 pounds than milk purchased from local producers. This fact is contrary to the belief of many local producers that processor-distributors are eager to purchase milk from other regions in preference to milk produced locally. The major factors which contribute to the higher costs for milk purchased from other regions are the cost of transportation and the season of the year in which the milk is available. Most of the milk brought in from other regions is purchased during the months of October, November,

Table V. The Volume of Milk Handled by Producer-Distributors and Processor-Distributors in the Upland Cotton Area During 1946

Market Area	Producer-Distributors		Processor-Distributors					
	Number	Total volume of milk handled in 1946 (1,000 pounds)	Per cent of Total	Number	Total volume of milk handled in 1946 (1,000 pounds)	Per cent of Total	Total (1,000 pounds)	Per cent
Monroe-El Dorado	16	3,216	23	3	11,021	77	14,237	100
Shreveport	5	1,915	6	3	30,476	94	32,391	100
Arcadia-Ruston	8	1,564	100	...	....	......	1,564	100
Homer-Haynesville	5	1,562	100	...	....	......	1,562	100
Minden	4	586	50	2[1]	586[2]	50[2]	1,172	100
Springhill	3	410	40	2[1]	656[2]	60[2]	1,066	100
Area total	41	9,253	18	6	41,497	82	50,750	100
Average	.....	226	.....	...	6,916	.....	....	....

[1] Processor-distributors in the Shreveport milkshed delivered milk in Minden and Springhill.

[2] Estimated.

Table VI. The Variation in the Number of Wholesale Milk Producers, the Amount of Milk Produced, and the Price Received per Hundredweight of Milk by Dairy Farmers in the Upland Cotton Area During 1946

ITEM	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly Average
Number of producers	217	221	222	235	252	249	245	254	256	243	243	247	240
Average lbs. of milk produced	10,765	10,156	14,023	14,662	14,126	16,087	12,569	12,204	10,958	9,923	7,885	8,897	142,559
Price received by:						(Weighted average per 100 pounds)							
Local producers	$3.89	$3 88	$3.90	$3.93	$3.88	$3.91	$4.78	$5.30	$5.32	$5.27	$5.63	$5.75	$4.53
Other Regions[1]	$5.53	$5.64	$5 69	$6.09	$6.39	$6.50	$7.07	$7.05	$6.96	$7.49	$7.43	$7 15	$6.85

[1] The Middle West primarily.

December, January and February. Historically, the price paid to farmers for milk during these months has been higher than prices paid during spring and summer months, primarily because the cost of producing winter milk is higher than the cost of producing milk during the spring and summer when grass is abundant. Normally, during the months of peak production, farmers in the Upland Cotton Area produce more milk than is sold as fluid milk or cream, and are forced to take a "surplus" price for that portion of their milk which dealers are unable to utilize as fluid milk. However, during 1946 all the milk purchased from local wholesale producers was used as fluid milk or fluid cream; therefore no milk was purchased at "surplus" price.

Processor-distributors in the Upland Cotton Area use two basic plans for determining the price paid to local farmers for wholesale milk. During 1946, 94 per cent of the milk used as fluid milk was purchased under the flat-rate price plan. Under this plan, the distributors quote a price per 100 pounds of milk containing 4 per cent butterfat, with a differential to establish a price for milk of higher or lower butterfat content. During periods when the volume of milk produced is higher than consumer demands for fluid milk, the pricing plan is a variation of the flat-rate and base-surplus plan. Six per cent of the milk purchased for fluid distribution in the Upland Cotton Area during 1946 was purchased on a butterfat basis. Under this system, fluid milk prices to farmers are quoted at a certain amount per pound of butterfat contained in whole milk. Where this plan is used differentials for butterfat in milk are not required.

Utilization of Milk Supply

During 1946 all of the milk produced and sold by local wholesale producers was used as fluid milk or fluid cream. Also, all whole milk purchased from other regions was sold as fluid milk. Fluid cream used in the area was obtained both from milk produced by farmers in the area and purchased from other regions. The skim milk and cream used in the manufacture of buttermilk, chocolate milk, butter, cottage cheese, and ice cream was obtained from other regions.

Table VII indicates that the volume of milk sold as fluid milk by the processor-distributors was approximately 42 million pounds, or about 82 per cent of the total fluid milk distributed by dealers in the area during 1946. Part of the fluid cream distributed by processor-distributors was obtained from local producers, i.e., by standardizing of milk containing higher than basic butterfat test, and part was purchased from distributors in other regions. All skim milk or butterfat used in the manufacture of buttermilk, chocolate milk, butter, cottage cheese, and ice cream was purchased from distributors in other regions.

Seasonal Variation in Milk Production

There was a great deal of seasonal variation in the amount of milk received by processor-distributors from producers in the Upland Cotton

Table VII. The Utilization of the Total Milk Supply by Processor-Distributors in the Upland Cotton Area During 1946

	VOLUME OF MILK SOLD AS:							
	Fluid milk, pounds (000)	Fluid Cream, pounds		Buttermilk, pounds (000)	Chocolate Milk, pounds (000)	Butter, pounds (000)	Cottage Cheese, pounds	Ice Cream, gallons
		Light (000)	Heavy (000)					
Monroe-El Dorado	11,021	175	164	232	......[1]	......[1]	3,482	......[1]
Shreveport	30,476	942	274	4,670	1,360	144,377	48,369	1,386,338
Total	41,497	1,117	438	4,902	1,360	144,377	51,851	1,386,338

[1] Not available.

Table VIII. Seasonal Variation in the Amount of Milk Received from Local Wholesale Producers by Processor-Distributors in the Upland Cotton Area During 1946

Month	Received from Local Producers		Percentage		Wt'd. Av. Price Per Cwt.		Percentatge of Average Value	
	Thousand Pounds		Per cent		Dollars		Per cent	
January	2336		6.83		3.89		5.87	
February	2244		6.56		3.88		5.62	
March	3073		9.98		3.90		7.75	
April	3401	3655	9.94	10.68	3.93	3.91	8.63	9.22
May	3560		10.40		3.88		8.92	
June	4006		11.71		3.91		10.11	
July	3079		9.00		4.78		9.53	
August	3100		9.06		5.30		10.61	
September	2805		8.20		5.32		9.64	
October	2411	2175	7.05	6.36	5.27	5.55	8.20	8.11
November	1916		5.60		5.63		6.97	
December	2198		6.42		5.75		9.16	
Total or average	34129		100.00		4.53		100.00	

Area during 1946. For each 100 pounds received during October, November and December, the period of lowest production, 168 pounds were received during April, May and June, the period of highest milk production (Table VIII).

During the three months of highest production, the dairy farmers marketed 32 per cent of their annual production and received only 27 per cent of the annual value of the milk produced and sold during 1946. On the other hand, during the three months of lowest production, they marketed 19 per cent of the annual volume of milk and received 23 per cent of the annual value.

The average price paid to dairy farmers during the three months of highest production was $3.91 per hundredweight of 4 per cent milk. They received an average of $5.55 during the three months of lowest production. This indicates that there was $1.64 per hundredweight difference in the price paid to farmers between the period of highest and lowest production. Despite this increase in price, farmers produced an average of 13 per cent less milk per month in the winter.

Figure II shows the seasonal variation in the quantity of milk received by dealers from local producers, and that purchased from other regions. There was an inverse relationship between local production and outside purchases. When local production increased, the quantity purchased from other regions decreased. Purchases from other regions

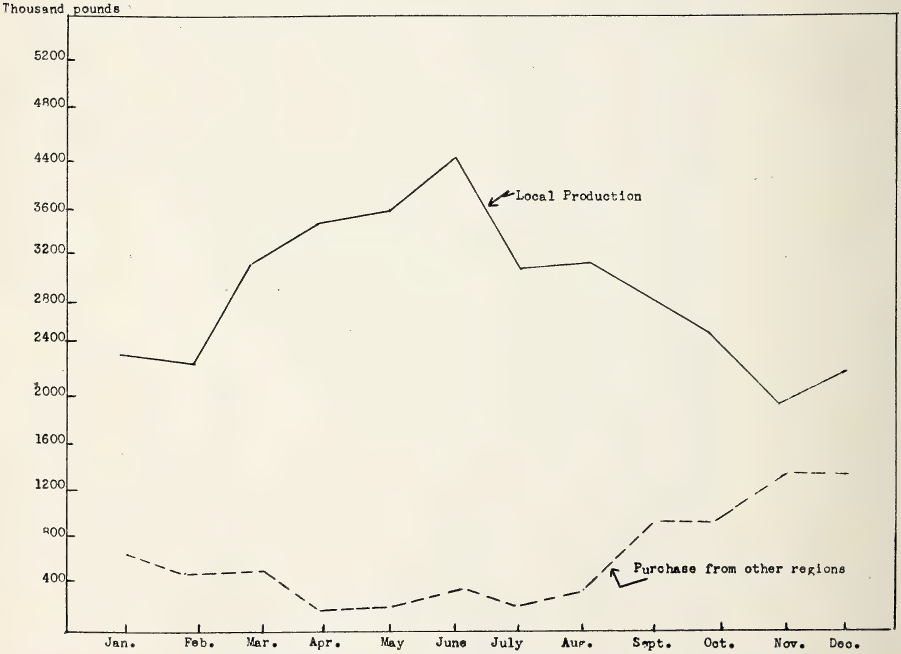


Figure II. The Amount of Milk Produced and Sold by Farmers in the Upland Cotton Area and the Amount of Whole Milk Purchased by Dealers from Other Regions During 1946.

begin to increase during August, and by November local producers were supplying only 60 per cent of the milk distributed by the processor-distributors. Dealers were buying about a half-million pounds of milk per month during the peak production period during 1946. This fact is important because it indicates that the local producers are "sharing" their market with producers in other regions.

Prior to the increase in demand for milk, which occured during World War II, processor-distributors in the larger market areas brought in milk from other regions only during the winter months when local production was short of demand. However, during and following the war, when demand was greater, they were forced to seek a supply of milk from surplus milk producing areas, even during the period of peak production by local dairy farmers. Dairy farmers in the Upland Cotton Area seldom produce enough milk to supply the demand of processor-distributors in the area during the winter. Thus the distributors must purchase milk from other regions of the country where the supply is available. This fact should be of great concern to dairy farmers in the area because the volume of milk brought in from other regions enjoys the highest price received during the year. The economic significance of this fact is evident. During the summer months of 1946, the processor-distributors were buying about a half-million pounds of milk per month from distributors in other regions, but increased their purchases to more than a million pounds per month during the winter. As pointed out earlier, the price per hundredweight of milk during the fall and winter months was about $1.64 more than the price in the spring and summer months. Therefore, if the amount of milk purchased from other regions was twice as great during the winter as in the summer, it appears that a greater seasonal variation in the price of local milk is needed or that a more equitable base-surplus plan is necessary in order to bring forth the needed adjustment in production.

The pattern of production and sales by local dairy farmers is almost the reverse of that indicated by outside purchases, i.e., they produce almost twice as much milk per month during the spring and summer as they do during the winter months. Therefore, the greatest proportion of their milk reaches the market when the price is lowest. This results in a yearly average price or blend price somewhat lower than would be the case if their pattern of production were more even throughout the year.

Although all the milk produced by local dairy farmers during 1946 was purchased and used as Class I or fluid milk by the dealers in the Upland Cotton Area, in most years prior to World War II the dealers were unable to use all milk as fluid milk, and therefore were forced to pay a "surplus" price for all above their Class I sales. It is likely that this condition will prevail again when the general price level declines.

Surplus production in an area brings with it many problems, both to the producers and dealers. It reduces the annual average or the producers' blend price. In the Upland Cotton Area, the value of the "surplus" milk is determined by the current price of butterfat and solids-not-fat in whole milk and not according to the use of milk. Therefore, if the milk is used for manufacturing ice cream the milk distributors gain a slight advantage over farmers because they buy all surplus milk at Class III prices and sell it in Class II.[1]

Many farmers expressed the opinion that the present system of determining the price of "surplus" milk does not give them returns commensurate with the use value of their total supply of milk. Under the present system, the price of "surplus" milk is determined by current butterfat quotations, while most of the "surplus" milk is not used for the manufacture of butter, but for the manufacture of ice cream. Many farmers also feel that the present method of establishing a winter base is inequitable. They maintain that the total sales of fluid milk during the winter months should be used as the base for springtime surplus. For illustration, assume that during December, when farmers are establishing their winter base, dealer A is receiving 10,000 gallons of milk which is sold as Class I, 6,000 gallons of which were produced by local producers and 4,000 gallons were purchased from dealers in other

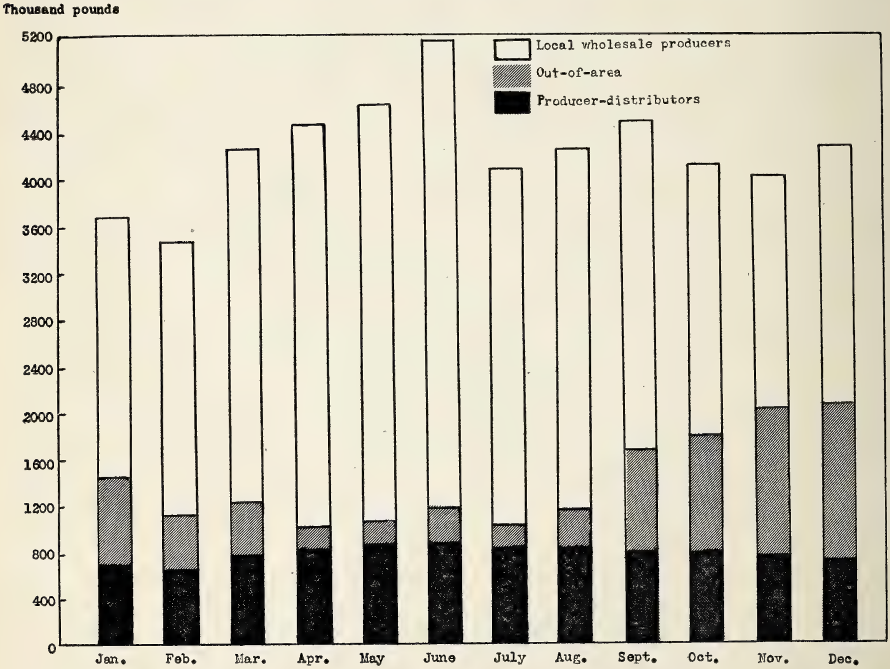


Figure III. The Source of Total Supply of Milk Distributed to Consumers in Urban Areas of the Upland Cotton Area During 1946.

---

[1] Class II milk is generally defined as milk used in ice cream, ice cream mix, and in the manufacture of all cheese except cheddar. Class III is usually manufactured into butter, dry milk solids, condensed and evaporated milk, etc. Ordinarily, farmers receive a higher price for milk used in Class II than for milk used in Class III.

regions. Assume also that Class I sales in June were 10,000 gallons. Under the present base-surplus price plan, the dealers could buy 6,000 gallons in Class I and 4,000 gallons as "surplus," and distribute the 10,000 gallons as Class I during the month of June.

Figure III shows the seasonal variation and the source of the total supply of milk consumed in the Upland Cotton Area during 1946. The supply of milk distributed each month by the producer-distributors was approximately the same. The supply of milk received from other areas varied considerably from season to season; also the receipts by processor-distributors from local producers varied greatly between summer and winter months.

The average butterfat of all milk handled by the processor-distributors was 4.5 per cent. There was considerable variation in the butterfat tests of producers in the different market areas. The average butterfat test of producers in the Monroe-El Dorado Area was about three points lower than the tests of producers in the Shreveport Market Area. The significance of the difference in butterfat tests between the two areas can be appreciated only when the differential rates for each one-tenth of a point butterfat are applied. Actually, the difference in butterfat tests resulted in about 18 cents per hundredweight less being received in the Monroe-El Dorado Market Area as compared to the price received in the Shreveport Market Area.

Butterfat tests of the producer-distributors were not available.

Per Capita Consumption of Milk

About half as much milk was consumed per capita in the urban centers of the Upland Cotton Area during 1946 as was consumed by the average consumer in the United States. In the Monroe-El Dorado Market Area the average consumption per capita was about 93 quarts of milk during 1946. This was less than half as many quarts of milk as were consumed by the average consumer in the United States (Table IX). The per capita consumption for consumers in the Shreveport Market Area was about 106 quarts of milk during 1946. The average consumption of milk per capita for the urban centers in the Upland Cotton Area was 101 quarts of milk annually, or approximately half the per capita consumption for the United States.

Some of the factors which may contribute to the lower per capita consumption in the Upland Cotton Area are the effective buying income per family and the racial composition of the population. The urban population of Shreveport and Monroe is 35 per cent colored, and it is generally recognized that the colored people do not consume as much milk per capita as do the non-colored population, due mainly to income and possibly to food habits. The per capita consumption of milk in the Monroe-El Dorado Market Area was 6 per cent less than in the Shreveport Area and 53 per cent less than the per capita consumption in the United States.

Table IX. A Comparison of the Amount of Milk Consumed per Capita in the Upland Cotton Area and the United States During 1946

Market Area	Quarts per year	Per cent of U. S. per capita consumption
Monroe-El Dorado	92.83	46.96
Shreveport	105.52	53.38
Upland Cotton Area	101.19	51.19
United States	197.67	100.00

Reliable data are not available which could be used to compare the net effective buying income per family in the Upland Cotton Area with family income in the United States. It is safe to assume, however, that the incomes of urban workers in the area would be about as great as family incomes in other urban centers of the United States. However, this study does not attempt to explain the reason for the low per capita consumption of milk in the Upland Cotton Area as compared with consumption of urban consumers in the United States.

The analysis of the marketing problem in the North Louisiana Upland Cotton Area is predicated upon two basic assumptions: (1) that all of the milk needed for urban consumption in the area could be produced by those producers already in production, or (2) the additional amount of milk needed could be produced within the area by increasing the number of producers.

During 1946 distributors in Shreveport, Monroe and El Dorado bought about 7.2 million pounds of whole milk from distributors in other regions of the country. If this milk had been produced in the Upland Cotton Area by the 240 dairy farmers who were already in production, each farmer would have needed to produce an additional 30,000 pounds of milk during the year. Receipts by distributors from dealers in other areas were lowest in July, when they received 196,131 pounds, and highest during October, November and December, when they brought in about one to one and a half million pounds of milk per month. If this volume of milk had been produced by the farmers already in production, each farmer would have had to almost double his production during the winter months. However, during the period of peak production, farmers in the area could have supplied the volume of milk needed by increasing production by only a few pounds per day. The 240 farmers may produce more milk than consumers will buy during the peak period of production in normal times, but generally they produce less than consumers buy during the winter months.

On the other hand, if the pattern of production by the dairy farmers already in production had remained the same and the 7.2 million pounds had been produced by increasing the number of dairy farmers, it would have required 51 additional "average" dairy farmers with an average production of 142,559 pounds of milk. The range in the number of additional average producers needed to supply the market would have been 15 during the three months of peak production and 136 during the three winter months. During the peak period of production the average production per farmer was 14,955 pounds of milk per month, whereas during the winter months the average production was 8,900 pounds per month.

It may be concluded, therefore, that the 240 dairy farmers in the Upland Cotton Area who were in production of milk during 1946 could have produced the total supply of milk needed by consumers in the area during the spring and summer months. However, it is unlikely that they could have produced the volume of milk distributed to consumers during the winter months since each dairy farmer would have had to almost double his production during this period. Analysis of the pattern of production by dairy farmers in the area indicates that the most feasible method of producing the total volume of milk needed to supply consumers in the urban centers of the Upland Cotton Area would be to increase the number of producers in the area. Under 1946 conditions, 51 additional producers were needed, but as consumer demand and patterns of production change, greater or lesser number of producers would be required, or greater volumes of milk used in the manufacture of dairy products.

Increased Per Capita Consumption

In order to make further analysis of the problem of marketing milk in the Upland Cotton Area, two additional assumptions have been made: (1) per capita consumption of milk by urban consumers in the Upland Cotton Area equivalent to 75 per cent of the average per capita consumption in the United States, (2) per capita consumption in the area equivalent to the per capita consumption in the United States.

Table IX shows that the per capita consumption of milk in the urban centers of the Upland Cotton Area was 51 per cent of the average consumption of milk by consumers in the United States during 1946. If per capita consumption in the area were increased to 148 quarts of milk per year, or 75 per cent of the average per capita consumption in the United States, an additional 12 million pounds of milk would be needed. On the other hand, if the per capita consumption in the area were 197 quarts, which was the per capita consumption in the U. S., approximately 76 million additional pounds of milk would be needed annually in the Upland Cotton Area. This is about 25 million pounds more milk than was consumed in the area during 1946. Based upon the assumption that the per capita consumption in the Upland Cotton Area could be increased to 75 or 100 per cent of the U. S. per capita consumption average, it would require 200 and 290 additional average producers, respectively.

Figure IV shows the number of producers who sold milk wholesale to processor-distributors in the Upland Cotton Area during 1946. Also it shows the number of average producers that would have been needed if the total supply of milk which was distributed in the area during 1946 were produced locally. It also shows the number of "average" producers that would have been required if the average per capita consumption were 75 and 100 per cent of the average per capita consumption in the United States.

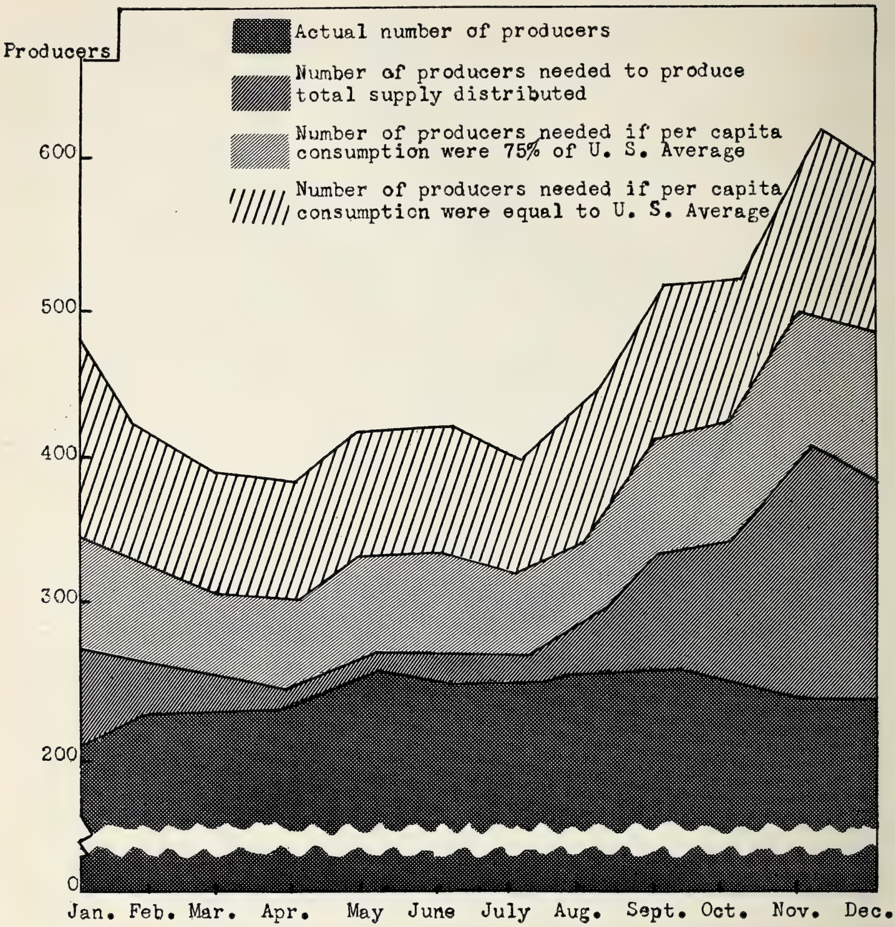


Figure IV. The Average Number of Producers Who Sold Milk at Wholesale in the Upland Cotton Area During 1946, the Number of Additional Producers Needed if all Milk Distributed Had Been Produced Locally, and the Number of Producers Needed if the Per Capita Consumption were 75 and 100 Per Cent of the Per Capita Consumption in the United States.

The number of wholesale producers in the Upland Cotton Area ranged from 217 in January to 256 in September and averaged 240 for the year (Table VI). Figure IV indicates that the greatest number of producers would be needed during the fall and winter months. The wide variation in the additional number of dairy farmers needed is due to the pattern of production by the farmers who were producing milk during 1946. The number of producers required to completely supply the markets in the Upland Cotton Area would be smaller if their pattern of production were adjusted so that an approximately even supply of milk reached the market during all months of the year.

Figure V shows the seasonal variation in the amount of milk that was marketed in the Upland Cotton Area during 1946 by local dairy farmers, the amount of milk that was distributed by processor-distributors, which includes out-of-area shipments, and the amount of milk which would have been distributed if the per capita consumption were 75 and 100 per cent of the U. S. average consumption.

The seasonal pattern of milk distributed by processor-distributors was fairly uniform, but the seasonal variation in the amount of milk supplied by local dairy farmers was great (Figure V). One of the greatest improvements that could be made in the dairy enterprise in the Upland Cotton Area is that of adjusting the pattern of milk production more in line with the needs of the market. Farm management practices which would help solve this problem are pointed out in a farm management analysis of the area made simultaneously with this study.[1]

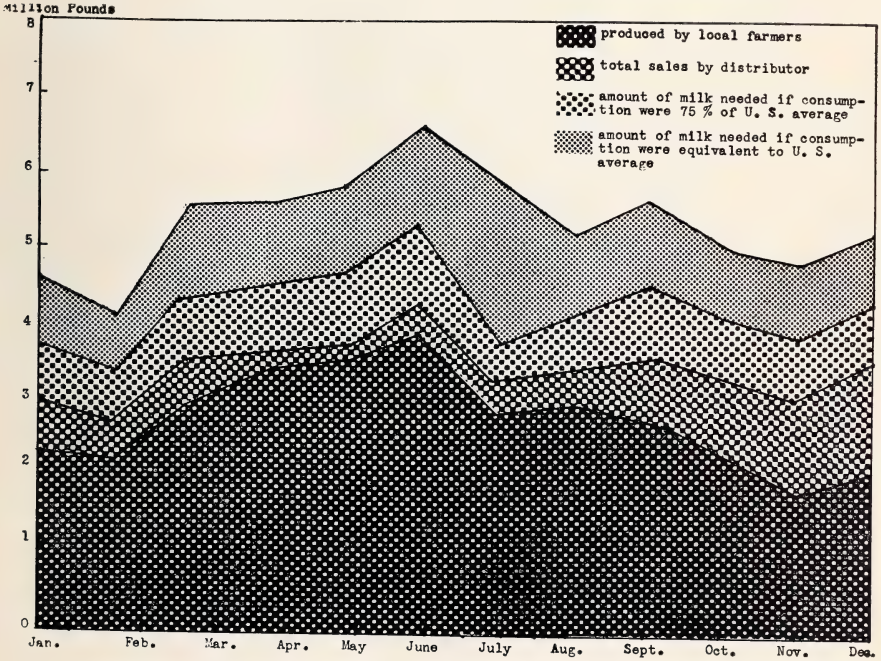


Figure V. The Total Volume of Wholesale Milk Produced by Farmers in the Upland Cotton Area during 1946, the Amount of Milk Distributed, and the Amount of Milk Which Would Have Been Sold if the Per Capita Consumption in the Area Were 75 and 100 Per Cent of the Average Per Capita Consumption in the United States.

---

[1] Ibid.

Farmers who do not adjust their production to the seasonal needs of the market will have more milk classified as "surplus" during the spring and summer when the effective demand for milk declines. This situation tends to reduce their average annual or blend price and their net returns from the sale of milk.

The seasonal peak shown during the early summer in Table V is a typical pattern of production in most milk producing areas. It is likely, therefore, that if all milk needed for local consumers were produced locally, there would necessarily be some milk during the spring and summer purchased as "surplus" or excess milk.

Summary and Conclusion

1. The data and conclusions in this report apply to the North Louisiana Upland Cotton Area which is composed of Bienville, Claiborne, DeSoto, Jackson, Lincoln, Sabine, Union, and Webster Parishes, and the hill sections of Bossier, Caddo and Ouachita Parishes.

2. Twenty-one cows were milked for each 100 acres of corn harvested in the North Louisiana Upland Cotton Area during 1945, twenty-two for each 100 acres of cotton harvested, and five for each 100 acres of cropland harvested.

3. There was an average of 16 cows milked per 100 population, or more than six persons per cow milked in the Upland Cotton Area during 1945. Forty-six per cent of employed male workers in the eight parishes included in the study were either farm operators, farm laborers or unpaid family farm workers.

4. There were six processor-distributors and 41 producer-distributors in the area during 1946. The former handled 42 million pounds of milk, or 82 per cent of the total supply distributed to consumers, and the latter handled 9 million pounds of milk, or 18 per cent of the supply distributed to consumers.

5. Urban consumers in the Upland Cotton Area purchased approximately 51 million pounds of fluid milk from distributors during 1946. Forty-four million pounds, or 84 per cent, was produced by local dairymen, and 7 million pounds, or 16 per cent, was purchased from distributors in other regions.

6. It would have required 15 additional "average" producers to have produced the amount of milk shipped in from other regions during June, and 162 additional "average" producers to produce the amount shipped in during November. It would have required 51 additional farmers who produced an average of 142,559 pounds of milk per year each, if all of the fluid milk distributed in the area had been produced locally.

7. If the local farmers who produced milk during 1946, had produced enough additional milk to equal the amount purchased from other regions, it would have required only minor daily increases during the flush season, but each farmer would have needed to double his production during the winter months.

8. Urban consumers in the Upland Cotton Area consumed an average of 101 quarts of fluid milk each during 1946, or 51 per cent of the national average. Twelve million additional pounds of milk would be needed if the per capita consumption increased to 148 quarts annually, or 75 per cent of the average per capita consumption in the United States. Twenty-six million additional pounds would be needed if per capita consumption were equal to 196.67 quarts, or the average per capita consumption in the United States.

9. Two hundred additional producers with an average annual production of 142,559 pounds of milk would be needed if the per capita consumption in the Area were 75 per cent of the per capita consumption in the United States. Two hundred and ninety additional "average" producers would be needed if the per capita consumption were equal to the United States per capita consumption.

10. The average price received by local dairy farmers for whole milk containing four per cent butterfat was $4.53 per hundredweight during 1946. The average net cost to distributors for whole milk containing four per cent butterfat which was shipped in from other regions was $6.85 per hundredweight. All of the milk produced and sold by local wholesale dairy farmers was used in Class I or fluid milk or cream during 1946, but normally farmers produce an excessive supply during the flush season and not enough to supply the demand in winter.

11. Ninety-four per cent of the fluid milk sold by local farmers was purchased under the flat-rate price plan. Under this plan, the distributors quote a price per 100 pounds of milk containing four per cent butterfat, with a differential to establish a price for milk with higher or lower butterfat content. Six per cent was purchased on a butterfat basis. Under this system fluid milk prices are quoted to farmers at a certain amount per pound of butterfat contained in whole milk.

12. There was a wide seasonal variation in the production of milk in the Upland Cotton Area during 1946. For each 100 pounds of local milk received by distributors during October, November and December, or the short production months, 168 pounds were received during April, May and June, or the months of flush production. The average amount of milk produced and sold each month by local wholesale producers varied from 7,885 in November to 16,087 pounds in June.

13. It appears that several million additional pounds of milk could be sold annually by local farmers if all distributors in the Upland Cotton Area would use local milk in the manufacture of ice cream, buttermilk, chocolate milk, butter, and cottage cheese. The study shows that most milk used in these products during 1946 was purchased from other regions. It is recognized that distributors might be required to condense and store some of the local milk supply during the flush season if the total supply of local milk is to be used in the production of these products.

14. Dairy farmers in the Upland Cotton Area must adjust their pattern of milk production in order to supply the market needs. This would require that farmers produce an approximately even supply of milk during all seasons of the year. The production of excess milk during the flush season reduces the blend price for milk; therefore farmers with a more even production receive the greatest net returns from their milk.

15. Producers and distributors should work together to obtain an increased per capita consumption of fluid milk by urban consumers in the Upland Cotton Area. This may require an adjustment in price from time to time in order that a greater volume of milk could be used in Class I or fluid milk.

16. A price plan should be developed for the area which would give farmers a price for milk according to its utilization by distributors. Consideration should be given to an equitable base-surplus plan and an adequate seasonal difference in the price of milk. This type of price plan probably would stimulate the production of milk locally during winter months, which would benefit producers, distributors and consumers.

TECHNOLOGY AND SCIENCE ROOM

2d set

Louisiana Bulletin No. 444 June, 1950

AGRICULTURAL STATISTICS FOR LOUISIANA

1909-1949

BY

J. P. MONTGOMERY

AND

STUART L. BRYAN

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
MAR 27 1

LOUISIANA COOPERATIVE CROP REPORTING SERVICE
LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, DIRECTOR
COOPERATING WITH
UNITED STATES
DEPARTMENT OF AGRICULTURE
BUREAU OF AGRICULTURAL ECONOMICS

CONTENTS

Introduction 5
Louisiana crop reporting districts (map) 7
Distribution of crop acreage by crop reporting districts, Table 1 7
Farms, farm property, and farm population, 1910-1945, Table 2 8
Louisiana's rank among States in crops and livestock production, 1947-49, Table 3 9
Cash receipts from farm marketings, value of products consumed in farm households, and government payments, 1924-49, Table 4 10
Cash receipts from farm marketings, by commodities, 1924-48, Table 5 11

Livestock and livestock products:

Cattle and calves: January 1 inventory, calf crop, and disposition, 1924-49, Table 6 15
Cattle and calves: Production, marketings, price, and income, 1924-49, Table 7 16
Cattle (dairy, other, and all): Number on farms, value per head, and farm value, January 1, 1909-50, Table 8 17
Cattle: Number on farms, by classes, January 1, 1920-50, Table 9 18
Dairy products: Production, disposition, and income, 1924-49, Table 10 19
Dairy products: Farm marketings, price, and value, 1924-49, Table 11 20
All hogs and pigs: Number on farms, value per head, and farm value, January 1, 1909-50, Table 12 21
Hogs: January 1 inventory, pig crop, and disposition, 1924-49, Table 13 22
Hogs: Production, marketings, price, and income, 1924-49, Table 14 23
All sheep including lambs: Number on farms, value per head, and farm value, January 1, 1909-50, Table 15 24
Sheep and lambs: January 1 inventory, lamb crop, and disposition, 1924-49, Table 16 25
Sheep and lambs: Production, marketings, price, and income, 1924-49, Table 17 26
Wool: Production, price, and value, 1909-49, Table 18 27
Workstock: Number on farms, value per head, and farm value, January 1, 1910-50, Table 19 28
All chickens: Number on farms, value per head, and farm value, January 1, 1924-50, Table 20 29
All chickens: January 1 inventory, production, disposition, price, and income, 1924-49, Table 21 30
Turkeys: January 1 inventory, production, disposition, price, and income, 1929-49, Table 22 31
Turkeys: Number on farms, value per head, and farm value, January 1, 1929-50, Table 23 32

CONTENTS-Continued

Eggs: Production, disposition, price, and value, 1924-49, Table 24 32
Honey bees: Number of colonies, production, price, and value of honey and of beeswax, 1939-49, Table 25 33
Package bees: Colonies for production of package bees, package bees shipped and queen bees shipped, 1944-49, Table 26 33

Crops:

Cotton lint: Acreage, yield, production, price, and value, 1909-49, Table 27 34
Cottonseed: Yield, production, price, and value, 1909-49, Table 28 35
Rice: Acreage, yield, production, price, and value, 1909-49, Table 29 36
Sugarcane (for sugar and seed): Acreage, yield, production, price, and value, 1909-49, Table 30 37
Sugarcane (for sugar): Acreage, yield, production, price, and value, 1909-49, Table 31 38
Sugarcane (for sirup): Acreage, yield, production, price, and value, 1909-49, Table 32 39
Sorghum (for sirup): Acreage, yield, production, price, and value, 1929-49, Table 33 40
Corn: Acreage planted with hybrid seed, 1938-49, Table 34 40
Corn: Acreage, yield, production, price, and value, 1909-49, Table 35 41
All hay: Acreage, yield, production, price, and value, 1909-49, Table 36 42
Alfalfa hay: Acreage, yield, and production, 1919-49, Table 37 . 43
Lespedeza hay: Acreage, yield, and production, 1924-49, Table 38 44
Annual legume hay: Acreage, yield, and production, 1919-49, Table 39 44
Miscellaneous hay: Acreage, yield, and production, 1929-49, Table 40 45
Tung nuts: Production, price, and value, 1939-49, Table 41 45
Oats: Acreage, yield, production, price, and value, 1909-49, Table 42 46
White clover seed: Acreage, yield, production, price, and value, 1930-49, Table 43 47
Lespedeza seed: Acreage, yield, production, price, and value, 1924-49, Table 44 47
Cowpeas (for peas): Acreage, yield, production, price, and value, 1924-49, Table 45 48
Cowpeas (for peas): Production, disposition, price, and value, 1924-49, Table 46 49
Velvet beans: Acreage, yield, production, price, and value, 1924-49, Table 47 50
Soybeans (for beans): Acreage, yield, production, price, and value, 1924-49, Table 48 51

CONTENTS-Continued

Soybeans (for beans): Production, disposition, price, and value, 1924-49, Table 49 52
Peanuts (picked and threshed): Acreage, yield, production, price, and value, 1909-49, Table 50 53
Irish potatoes (all): Acreage, yield, production, price, and value, 1909-49, Table 51 54
Sweetpotatoes: Acreage, yield, production, price, and value, 1909-49, Table 52 55
Tobacco (perique): Acreage, yield, production, price, and value, 1919-49, Table 53 56
Strawberries: Acreage, yield, production, price, and value, 1918-49, Table 54 57
Oranges: Production, disposition, price, and value, 1919-49, Table 55 58
Peaches: Production, price, and value, 1909-49, Table 56 59
Pears: Production, price, and value, 1909-49, Table 57 60
Pecans (improved and seedling): Production, price, and value, 1919-49, Table 58 61
Snap beans (mid-spring market): Acreage, yield, production, price, and value, 1918-49, Table 59 62
Snap beans (early fall market): Acreage, yield, production, price, and value, 1922-49, Table 60 63
Cabbage (market): Acreage, yield, production, price, and value, 1918-49, Table 61 64
Watermelons (market): Acreage, yield, production, price, and value, 1934-49, Table 62 65
Beets (market). Acreage, yield, production, price, and value, 1927-49, Table 63 65
Cucumbers (early fall market): Acreage, yield, production, price, and value, 1928-49, Table 64 66
Cucumbers (late spring market): Acreage, yield, production, price, and value, 1923-49, Table 64 66
Tomatoes (market): Acreage, yield, production, price, and value, 1925-49, Table 65 67
Onions (market): Acreage, yield, production, price, and value, 1918-49, Table 66 68
Garlic (market): Acreage, yield, production, price, and value, 1932-49, Table 67 68
Shallots (market): Acreage, yield, production, price, and value, 1937-49, Table 68 69
Eggplant (market): Acreage, yield, production, price, and value, 1925-49, Table 69 70
Green peppers (market): Acreage, yield, production, price, and value, 1924-49, Table 70 70
Carrots (market): Acreage, yield, production, price, and value, 1923-49, Table 71 71
Spinach (market): Acreage, yield, production, price, and value, 1925-49, Table 72 72
Commercial truck crops for processing: Acreage, production, and value, 1928-49, Table 73 72

AGRICULTURAL STATISTICS FOR LOUISIANA
1909-1949

J. P. Montgomery
Department of Agricultural Economics
Agricultural Experiment Station
Louisiana State University
and
Stuart L. Bryan
Bureau of Agricultural Economics
United States Department of Agriculture

There is an ever growing need for a basic statistical handbook of Louisiana agriculture. To meet this increasing need for more State statistics on agriculture showing long-time trends, this compilation has been made for Louisiana through the Louisiana Cooperative Crop reporting Service. The Crop Reporting Office in Louisiana represents both the United States Department of Agriculture and the Louisiana State University. Formal cooperation exists between the Department of Agricultural Economics of the University. and the Louisiana Office of Agricultural Estimates, Bureau of Agricultural Economics, United States Department of Agriculture. The tables are compiled from established series which are released regularly by the Louisiana Cooperative Crop Reporting Service or by the Department from Washington, and therefore can be kept up to date. These statistics are useful to the farmer in planning a more efficient program for producing and marketing his products. Agricultural statistics are of importance to processors and distributors in bridging the gap between the farm and the ultimate consumer, benefiting both producer and consumer. They are used by manufacturers of farm machinery and supplies in planning their operations.

In addition to the original users of agricultural statistics—research workers, educators, farmers, processors, distributors, and lending agencies—the Government itself in recent years has been making increased use of agricultural statistics. Government action in the fields of production control, allocations, price supports, and conservation are based upon statistical information.

Workers in need of agricultural statistics frequently find that they do not have the proper reports on file, or that their files are incomplete, or lack the latest revisions. The remedy for this is the assembling of the more important agricultural statistics in a single report. The purpose of this bulletin is to make the data on Louisiana agriculture, released by the Crop and Livestock Reporting Service in the various reports, more readily available to agricultural workers. This publication comprises statistics on the more important agricultural enterprises and commodities for Louisiana from 1909 through 1949. It should be relatively easy for those interested to supplement these data from the various current series of releases and to keep them up to date.

These data include annual production, disposition, price, and value of various livestock and livestock products in Louisiana, as well as acreage, yield, production, price, and value of the more important crops produced in the State, from 1909 through 1949. Attempts have been made to organize the data in such tables that they will be of the greatest value to those in need of information on Louisiana's agriculture in time series.

The data included in this bulletin are the latest official statistics of the United States Department of Agriculture with the exception of those in Tables 1 and 2, which are taken from the Bureau of the Census, United States Department of Commerce.

The "cash receipts" data shown in the following tables represent the monetary returns from farm marketings during each calendar year. The "value of production" information, however, represents the total farm value of the commodity produced during the crop year whether sold or consumed on the farm, with the average sale price of that sold applied also to the portion of the crop unsold to compute total farm value. Cash receipts are in all cases shown on a calendar-year basis, while value of production is shown on a crop-year basis. In a few tables the data are shown representing the value of sales. These represent the portion of the commodity sold during the crop year, excluding any unsold portions whether due to farm consumption or to economic abandonment.

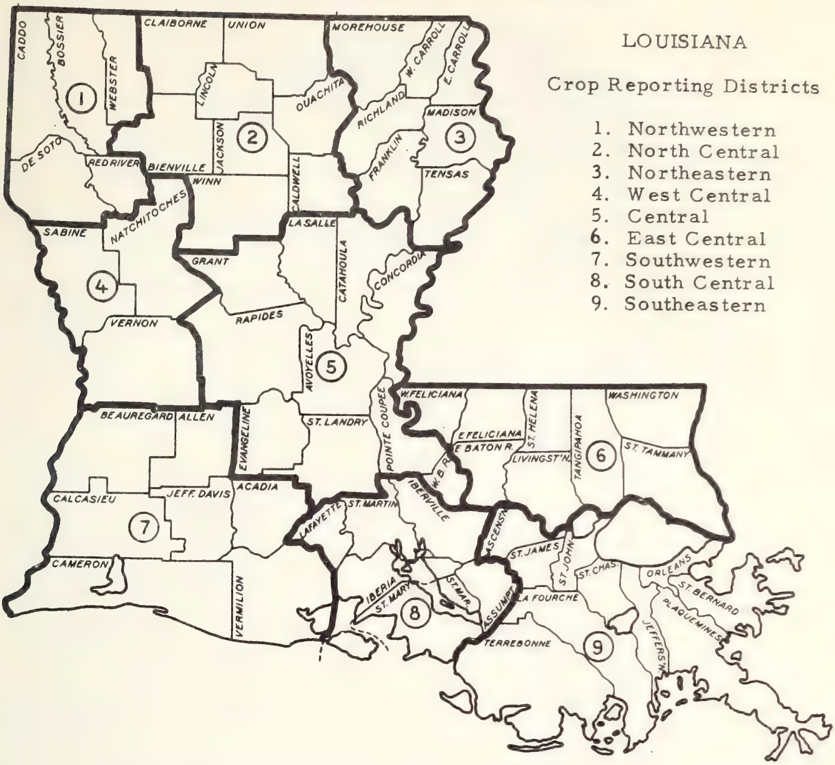


Table 1. - Distribution of crop acreage by crop reporting districts, 1945 Census

Crop	Percent of total acreage harvested									State total
	District 1	District 2	District 3	District 4	District 5	District 6	District 7	District 8	District 9	
Cotton	18.3	16.4	28.3	4.4	19.6	4.5	3.9	4.5	.1	100.0
Rice	- -	- -	- -	- -	12.9	.1	81.6	4.4	1.0	100.0
All sugarcane	.1	.3	*	.2	10.8	2.2	3.1	52.0	31.3	100.0
Irish potatoes	2.5	10.3	2.6	3.1	25.0	17.9	3.8	7.4	27.4	100.0
Sweet potatoes	4.5	7.1	3.3	2.6	38.1	10.0	13.0	19.5	1.9	100.0
All corn	7.9	13.1	15.6	3.8	23.2	11.8	3.9	12.6	8.1	100.0
Oats for grain	17.4	7.8	48.4	3.1	10.0	7.9	4.0	.4	1.0	100.0
All sorghums	20.5	16.0	28.1	8.7	10.7	9.2	4.0	.6	2.2	100.0
Soybeans planted alone	7.6	7.0	16.2	2.0	17.8	9.2	2.2	28.5	9.5	100.0
Soybeans interplanted	.4	1.7	10.4	1.7	41.6	1.0	2.9	31.2	9.1	100.0
Cowpeas planted alone	23.6	44.7	5.8	7.7	5.5	6.5	2.4	1.4	2.4	100.0
Cowpeas interplanted	12.5	16.4	15.7	18.1	7.9	9.7	3.8	10.2	5.7	100.0
Peanuts planted alone	28.5	37.4	.6	14.5	9.1	4.5	5.1	.1	.2	100.0
Alfalfa hay	73.6	.9	11.1	5.9	2.8	1.2	- -	1.7	2.8	100.0
Lespedeza hay	2.2	8.1	53.2	1.5	11.2	15.3	5.9	1.2	1.4	100.0
Grain hay	4.9	7.7	35.5	4.9	26.2	10.9	3.8	2.2	3.9	100.0
Other tame hay	5.0	2.2	3.0	13.0	50.4	12.1	.9	7.0	6.4	100.0
Wild hay	18.7	3.8	12.4	3.3	14.4	6.4	10.0	26.8	4.2	100.0
Lespedeza seed	.1	2.2	8.1	.3	8.2	78.1	2.9	.1	- -	100.0

* Less than one-tenth of one percent.

Table 2. - Farms, farm property, and farm population, 1910-45 Censuses 1/

Item		1945	1940	1935	1930	1925	1920	1910
Farms	Number	129,295	150,007	170,216	161,445	132,450	135,463	120,546
Land in farms	Acres	10,039,657	9,996,108	10,444,288	9,355,437	8,837,502	10,019,822	10,439,481
Average size of farms	Acres	77.6	66.6	61.4	57.9	66.7	74.0	86.6
Total cropland	Acres	5,135,416	6,038,067	5,876,097	5,656,234	5,064,031	5,626,226 2/	5,276,016 2/
Average cropland per farm	Acres	39.7	40.3	34.5	35.0	38.2	41.5	43.8
Value of farms (land and buildings)	Dollars	472,327,792	353,873,506	295,515,197	418,191,773	324,678,074	474,038,793	237,544,450
All farm operators	Number	129,295	150,007	170,216	161,445	132,450	135,463	120,546
Full owners	Number	58,761	52,936	54,891	46,893	47,913	51,895	48,590
Part owners	Number	6,433	7,376	6,429	6,266	4,473	5,359	4,399
Managers	Number	560	528	519	735	503	828	950
Tenants	Number	63,541	89,167	108,377	107,551	79,561	77,381	66,607
Total population	Number	2,291,000 3/	2,363,880	2,266,023 3/	2,101,593	1,972,085 3/	1,798,509	1,656,388
Farm population	Number	594,127	853,949	859,351	830,606	696,179	786,050	-
Percent of total	Percent	25.9	36.1	37.9	39.5	35.3	43.7	-

1/ Items related to land use refer to year previous to that shown.

2/ Not exactly comparable with later censuses.

3/ Estimates by Bureau of the Census.

Table 3. - Louisiana's rank among States in crops and livestock production, 1947-49

Commodity	Rank		
	1947	1948	1949
Crops			
Cotton lint	7	9	6
Cottonseed	8	8	6
Rice	1	1	1
Sugarcane for sugar and seed	1	1	1
Sugarcane sirup	4	1	2
Sweet potatoes	1	1	1
Irish potatoes			
All states	38	36	36
Early commercial states	8	9	10
Corn	27	28	26
Oats	32	32	34
Soybeans for beans	20	21	20
Hay, all	45	45	43
Tung nuts	3	2	2
Cowpeas for peas	8	7	7
Velvet beans	6	6	6
Peanuts picked and threshed	13	13	13
Tobacco	20	20	21
Lespedeza seed	15	15	15
Sorgo sirup	17	17	18
Livestock			
Cattle and calves (pounds)	29	29	28
Hogs (pounds)	26	25	26
Sheep and lambs (pounds)	35	35	35
Chickens (pounds)	28	29	28
Turkeys (pounds)	45	46	45

Table 4.- Cash receipts from farm marketings, value of products consumed in farm household, and government payments, 1924-49.

Year	Crops		Livestock and livestock products		Cash receipts from farm marketings	Value of home consumption	Government payments	Cash receipts from farm marketings and government payments	Cash receipts from farm marketings, value of home consumption, and government payments
	Cash receipts from farm marketings	Value of home consumption	Cash receipts from farm marketings	Value of home consumption					
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1924	99,974	10,738	21,510	19,830	121,484	30,568	- - - -	121,484	152,052
1925	135,522	13,780	23,204	19,608	158,726	33,388	- - - -	158,726	192,114
1926	109,433	13,708	25,174	21,240	134,607	34,948	- - - -	134,607	169,555
1927	99,646	13,521	26,280	21,285	125,926	34,806	- - - -	125,926	160,732
1928	110,475	12,348	25,816	20,809	136,291	33,157	- - - -	136,291	169,448
1929	134,771	13,455	27,026	20,170	161,797	33,625	- - - -	161,797	195,422
1930	83,845	12,002	24,393	19,397	108,238	31,399	- - - -	108,238	139,637
1931	65,135	11,241	17,683	17,000	82,818	28,241	- - - -	82,818	111,059
1932	47,375	9,653	13,913	13,508	61,288	23,161	- - - -	61,288	84,449
1933	51,271	9,502	13,484	12,896	64,755	22,398	4,970	69,725	92,123
1934	72,872	10,459	15,451	15,162	88,323	25,621	7,563	95,886	121,507
1935	85,846	11,686	20,344	17,720	106,190	29,406	20,358	126,548	155,954
1936	108,179	11,653	20,864	19,066	129,043	30,719	5,383	134,426	165,145
1937	97,519	11,365	23,804	19,144	121,323	30,509	7,178	128,501	159,010
1938	82,541	11,789	24,680	18,203	107,221	29,992	17,596	124,817	154,809
1939	84,610	12,441	24,955	17,808	109,565	30,249	21,184	130,749	160,998
1940	66,764	10,601	26,346	16,587	93,110	27,188	21,902	115,012	142,200
1941	84,480	11,322	32,907	19,045	117,387	30,367	16,799	134,186	164,553
1942	139,963	12,533	44,573	23,006	184,536	35,539	9,756	194,292	229,831
1943	183,827	16,285	57,646	29,276	241,473	45,561	17,400	258,873	304,434
1944	174,420	16,085	63,185	27,881	237,605	43,966	17,020	254,625	298,591
1945	186,582	19,995	71,644	29,845	258,226	49,840	12,796	271,022	320,862
1946	172,732	21,652	82,725	36,447	255,457	58,099	11,795	267,252	325,351
1947	227,544	26,850	107,853	40,080	335,397	66,930	9,079	344,476	411,406
1948	243,785	28,408	107,575	42,290	351,360	70,698	8,558	359,918	430,616
1949 1/	246,022		96,129		342,151		9,093	351,244	

1/ Preliminary

Table 5. - Cash receipts from farm marketings, by commodities, 1924-48

Commodity	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
LIVESTOCK AND PRODUCTS	21,510	23,204	25,174	26,280	25,816	27.026	24,393	17,683	13,913	13,484	15,451	20,344	20,864
Cattle and calves	4,786	4,997	4,789	7,233	7,753	7,657	6,186	4,671	3,649	3,203	4,127	7,359	6,729
Hogs	4,723	5,949	6,898	5,281	3,537	4,135	3,955	2,551	2,841	2,986	3,735	4,383	4,892
Dairy products	6,899	6,780	7,586	7,806	7,931	8,668	7,937	6,597	5,040	5,188	5,743	5,883	6,344
Eggs	2,792	3,108	3,432	2,919	3,608	3,572	2,794	1,755	946	1,009	1,080	1,767	1,758
Chickens	1,816	1,740	1,969	2,424	2,319	2,328	2,873	1,678	1,072	658	354	441	613
Other 1/	494	630	500	617	668	666	648	431	365	440	412	511	528
CROPS	99,974	135,522	109,433	99,646	110,475	134,771	83,845	65,135	47,375	51,271	72,872	85,846	108,179
Field crops													
Cotton lint	50,444	78,069	57,445	53,525	55,211	78,080	36,820	27,199	18,108	20,589	36,763	32,536	46,163
Cottonseed	5,240	10,271	6,729	6,508	7,988	7,946	5,114	2,134	2,192	2,040	5,767	6,050	9,817
Rice	17,407	18,706	17,064	16,367	16,244	16,828	15,033	9,510	5,455	7,169	8,715	18,868	14,165
Sugarcane for sugar	6,852	10,708	4,251	4,435	7,180	11,001	8,649	7,343	8,831	8,554	7,034	12,997	18,008
Sugarcane sirup	4,198	2,218	1,735	1,924	2,288	2,121	2,073	1,500	1,011	1,524	2,240	2,223	2,208
Potatoes	1,400	1,454	2,462	2,020	1,666	1,446	1,999	1,188	810	976	895	1,135	2,532
Sweet potatoes	1,330	1,637	1,571	1,883	1,491	1,948	1,410	1,146	973	1,169	1,712	1,727	2,014
Corn	998	1,196	1,409	1,243	1,400	874	638	702	483	253	341	820	782
Oats	12	13	20	9	8	8	9	18	6	5	15	13	15
Hay	413	237	408	367	449	482	380	347	290	220	226	189	279
Soybeans	70	174	337	333	369	316	437	263	128	58	56	116	165
Truck crops	2,496	3,500	4,106	3,572	3,731	4,090	2,683	2,937	2,623	2,456	2,972	3,566	4,159
Tung nuts 2/	-	-	-	-	-	-	-	-	-	-	-	-	-
Other 3/	800	867	860	383	407	346	262	317	279	233	308	239	301

Continued

Table 5. - Cash receipts from farm marketings, by commodities, 1924-48, continued

Commodity	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Fruits and tree nuts													
Strawberries	4,939	2,630	7,272	3,866	8,565	5,943	5,279	8,199	4,203	3,743	3,838	2,842	4,708
Pecans	315	747	680	306	504	304	580	356	213	314	187	246	350
Peaches	126	172	111	18	131	110	79	213	33	107	104	125	209
Oranges	132	227	346	544	525	687	422	382	470	411	399	461	441
Other 4/	117	120	114	99	124	122	127	125	73	81	107	104	138
Other products													
Forest	2,090	1,954	1,891	1,635	1,588	1,535	1,348	837	889	1,098	893	1,240	1,316
Greenhouse, nursery	595	622	622	609	606	584	503	419	305	271	300	349	409
TOTAL LIVESTOCK AND CROPS	121,484	158,726	134,607	125,926	136,291	161,797	108,238	82,818	61,288	64,755	88,323	106,190	129,043

Continued

Table 5. - Cash receipts from farm marketings, by commodities, 1924-48, continued

Commodity	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
LIVESTOCK AND PRODUCTS	23,804	24,680	24,955	26,346	32,907	44,573	57,646	63,185	71,644	82,725	107,853	107,575
Cattle and calves	7,717	8,206	8,048	9,438	11,581	12,525	14,795	16,685	23,788	33,264	46,062	43,903
Hogs	5,533	6,169	5,847	4,731	6,506	11,006	12,816	15,440	16,092	17,946	25,206	25,203
Dairy products	6,848	7,195	7,179	7,611	8,643	11,594	14,331	15,159	14,781	17,087	21,085	21,950
Eggs	2,101	1,995	2,170	2,002	3,084	4,909	7,295	7,317	7,493	6,208	6,443	7,219
Chickens	974	604	1,207	1,801	2,150	3,191	6,875	7,074	7,715	6,402	6,820	6,866
Other 1/	631	511	504	763	943	1,348	1,534	1,510	1,775	1,818	2,237	2,434
CROPS	97,519	82,541	84,610	66,764	84,480	139,963	183,827	174,420	186,582	172,732	227,544	243,785
Field crops												
Cotton lint	41,635	31,021	33,943	24,962	24,968	46,946	68,039	68,350	59,765	36,712	83,393	107,690
Cottonseed	6,585	4,813	5,102	3,106	5,100	9,476	13,153	10,226	6,791	5,048	13,468	17,773
Rice	13,949	13,670	12,097	15,542	21,057	36,014	40,000	36,938	38,634	40,452	56,751	47,032
Sugarcane for sugar	15,301	15,526	14,599	7,704	15,437	20,671	25,347	24,164	28,765	29,346	28,645	27,869
Sugarcane sirup	2,568	2,210	2,670	1,820	2,703	2,951	3,508	4,041	9,824	12,772	6,091	1,436
Potatoes	1,300	1,237	1,180	1,371	1,208	2,043	4,368	3,099	3,552	2,199	1,792	1,674
Sweet potatoes	1,411	1,267	1,390	1,058	1,402	2,931	7,974	4,915	11,084	9,899	7,846	6,606
Corn	689	1,270	703	690	891	1,468	1,792	1,145	1,455	1,820	1,781	2,236
Oats	71	54	78	124	229	388	514	877	740	554	805	914
Hay	206	240	265	338	378	382	432	624	621	765	1,071	793
Soybeans	300	117	188	139	170	818	705	824	730	639	867	897
Truck crops	5,342	4,297	4,795	3,073	3,516	4,487	7,425	7,177	9,223	12,081	8,791	10,594
Tung nuts 2/	-	-	—	-	-	-	-	-	1,086	1,368	1,068	998
Other 3/	329	405	313	291	145	760	736	458	683	557	603	561

Continued

Table 5. - Cash receipts from farm marketings, by commodities, 1924-48, continued

Commodity	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948
	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Fruits and tree nuts												
Strawberries	4,882	3,691	4,434	3,671	3,497	6,199	4,350	4,846	7,696	11,450	7,830	8,730
Pecans	307	213	265	675	475	857	1,739	2,747	1,724	2,450	898	1,605
Peaches	129	142	207	170	185	230	260	720	770	5/	5/	5/
Oranges	581	536	429	228	204	729	768	388	1,105	725	717	480
Other 4/	85	139	125	170	145	231	162	359	453	1,207	856	1,015
Other products												
Forest	1,401	1,244	1,358	1,127	2,254	1,851	2,036	2,000	1,397	2,048	3,537	4,104
Greenhouse, nursery	448	449	469	505	516	531	519	522	484	640	734	778
TOTAL LIVESTOCK AND CROPS	121,323	107,221	109,565	93,110	117,387	184,536	241,473	237,605	258,226	255,457	335,397	351,360

1/ Includes sheep and lambs, turkeys, other poultry, wool, horses, mules, honey, beeswax, and bees.
2/ Included under "other" prior to 1945.
3/ Includes sorghum for grain, peanuts, sorgo sirup, cowpeas, lespedeza and white clover seed, and tobacco.
4/ Includes apples, apricots, figs, grapes, pears, plums, other berries, grapefruit, kumquats, and peaches beginning with 1946.
5/ Included in "other."

Table 6. - Cattle and calves: January 1 inventory, calf crop, and disposition, 1924-49

Year	On hand Jan. 1		Calves born		In shipments	Marketings 1/		Farm slaughter		Deaths	
	All cattle	All cows 2 yrs. +	Percent of cows 2 yrs. +	Number		Cattle	Calves	Cattle	Calves	Cattle	Calves
	1,000 head	1,000 head	Per-cent	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head
1924	884	490	54	265	11	139	56	24	14	28	28
1925	871	493	53	261	8	144	66	15	19	30	30
1926	836	485	55	269	15	130	81	18	12	30	30
1927	819	480	63	302	20	177	86	11	11	24	22
1928	810	473	62	292	30	134	109	15	5	28	22
1929	819	480	62	297	17	136	92	16	4	28	21
1930	836	437	61	295	20	147	65	12	8	28	22
1931	869	495	61	303	16	139	57	12	10	25	25
1932	920	520	61	319	15	141	48	15	15	23	26
1933	986	548	61	337	12	144	41	15	15	24	26
1934 2/	1,070	582	64	373	10	174	58	30	7	24	35
1935 2/	1,125	602	63	379	9	270	72	12	15	34	30
1936	1,080	607	67	407	12	215	80	12	15	33	42
1937	1,102	608	68	413	13	221	95	10	13	29	35
1938	1,125	629	67	421	18	255	85	7	11	25	33
1939	1,148	615	70	430	19	213	102	10	12	26	30
1940	1,204	656	68	446	18	234	115	7	11	43	42
1941	1,216	663	68	451	15	216	131	7	10	34	44
1942	1,240	709	73	518	13	158	180	6	9	32	35
1943	1,351	761	72	548	24	156	176	6	9	35	41
1944	1,500	825	70	578	22	211	214	8	13	40	53
1945	1,561	894	68	608	45	288	235	7	12	40	55
1946	1,577	915	69	631	50	356	261	9	14	43	61
1947	1,514	893	68	607	33	409	313	7	12	40	41
1948	1,332	815	73	595	24	262	275	4	10	32	36
1949	1,332	796	79	629	23	198	265	9	8	25	40

1/ Excludes interfarm sales.
2/ Includes Government purchases.

Table 7 Cattle and calves: Production, marketings, price, and income, 1924-49

Year	Production	Marketings 1/.	Average price per 100 pounds		Cash receipts	Value of home consumption	Gross income	Cost of in-shipmen
			Cattle	Calves				
	1,000 pounds	1,000 pounds	Dollars	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1924	98,100	91,240	4.65	5.50	4,786	289	5,075	167
1925	94,145	95,640	4.70	6.00	4,997	231	5,228	134
1926	88,740	89,340	4.70	6.50	4,789	234	5,023	270
1927	116,280	118,240	5.70	7.20	7,233	189	7,422	432
1928	96,960	95,660	7.30	9.50	7,753	262	8,015	828
1929	101,745	94,480	7.30	9.70	7,657	272	7,929	405
1930	112,805	97,300	5.80	8.20	6,186	196	6,382	378
1931	115,995	91,380	4.70	6.00	4,671	164	4,835	174
1932	123,445	91,320	3.65	4.30	3,649	164	3,813	131
1933	132,765	92,140	3.15	4.15	3,203	147	3,350	84
1934 2/	131,585	109,000	3.45	4.10	4,127	237	4,364	70
1935 2/	156,240	169,200	4.20	5.30	7,359	167	7,526	132
1936	154,215	140,725	4.50	5.40	6,729	176	6,905	168
1937	160,440	145,900	5.00	6.10	7,717	166	7,883	237
1938	172,435	168,725	4.65	5.90	8,206	119	8,325	353
1939	172,080	145,230	5.20	6.60	8,048	170	8,218	459
1940	168,445	162,625	5.50	6.80	9,438	142	9,580	469
1941	173,980	159,140	6.80	8.60	11,581	174	11,755	450
1942	177,830	135,250	8.40	10.60	12,525	201	12,726	493
1943	189,695	134,080	10.20	12.00	14,795	236	15,031	989
1944	197,555	165,270	9.20	11.20	16,685	299	16,984	1,044
1945	202,575	216,225	10.30	12.20	23,788	301	24,089	2,409
1946	215,835	257,385	12.00	14.80	33,264	433	33,697	3,282
1947	208,955	292,920	14.50	18.40	46,062	438	46,500	2,888
1948	196,945	216,590	18.60	22.90	43,903	415	44,318	2,727
1949	224,220	187,580	17.70	21.40	36,810	543	37,353	2,208

1/ Excludes interfarm sales.
2/ Includes Government purchases.

Table 8. - Cattle (dairy, other, and all): Number on farms, value per head, and farm value, January 1, 1909-50

Year	Number			Value per head			Farm value		
	Dairy 1/	Other	All	Dairy	Other	All	Dairy	Other	All
	1,000 head	1,000 head	1,000 head	Dollars	Dollars	Dollars	1,000 dollars	1,000 dollars	1,000 dollars
1909	222	558	780	23.50	10.00	13.80	5,217	5,580	10,797
1910	237	511	748	24.30	10.30	14.70	5,759	5,263	11,022
1911	240	515	755	29.50	11.60	17.30	7,080	5,974	13,054
1912	250	515	765	29.50	11.20	17.20	7,375	5,768	13,143
1913	250	530	780	29.00	12.00	17.40	7,250	6,360	13,610
1914	250	560	810	34.00	15.30	21.10	8,500	8,568	17,068
1915	250	590	840	36.00	16.40	22.20	9,000	9,676	18,676
1916	242	643	885	37.00	16.80	22.30	8,954	10,802	19,756
1917	240	695	935	42.00	20.00	25.60	10,080	13,900	23,980
1918	230	750	980	49.50	24.20	30.10	11,385	18,150	29,535
1919	220	825	1,045	58.00	26.80	33.40	12,760	22,110	34,870
1920	220	730	950	61.00	29.12	36.50	13,420	21,255	34,675
1921	225	706	931	47.00	21.94	28.00	10,575	15,493	26,068
1922	233	679	912	39.00	13.88	20.30	9,087	9,427	18,514
1923	242	660	902	35.00	13.00	18.90	8,470	8,578	17,048
1924	248	636	884	34.00	13.29	19.10	8,432	8,452	16,884
1925	253	618	871	34.00	11.17	17.80	8,602	6,902	15,504
1926	245	591	836	31.00	14.31	19.20	7,595	8,456	16,051
1927	250	569	819	33.00	15.30	20.70	8,250	8,703	16,953
1928	256	554	810	36.00	18.02	23.70	9,216	9,981	19,197
1929	253	566	819	49.00	24.26	31.90	12,397	13,729	26,126
1930	250	586	836	47.00	23.75	30.70	11,750	13,915	25,665
1931	257	612	869	36.00	17.11	22.70	9,252	10,474	19,726
1932	270	650	920	30.00	13.30	18.20	8,100	8,644	16,744
1933	280	706	986	21.00	9.97	13.10	5,880	7,037	12,917
1934	298	772	1,070	23.00	9.54	13.30	6,854	7,362	14,216
1935	310	815	1,125	24.00	10.45	14.20	7,440	8,515	15,955
1936	310	770	1,080	29.00	14.41	18.60	8,990	11,098	20,088
1937	316	786	1,102	32.00	14.33	19.40	10,112	11,267	21,379
1938	322	803	1,125	32.00	15.33	20.10	10,304	12,308	22,612
1939	329	819	1,148	34.00	16.76	21.70	11,186	13,726	24,912
1940	335	869	1,204	36.00	19.10	23.80	12,060	16,595	28,655
1941	335	881	1,216	37.00	19.81	24.50	12,395	17,454	29,849
1942	342	898	1,240	48.00	26.18	32.20	16,416	23,512	39,928
1943	356	995	1,351	62.00	31.99	39.90	22,072	31,833	53,905
1944	367	1,133	1,500	68.00	34.24	42.50	24,956	38,794	63,750
1945	379	1,182	1,561	68.00	33.27	41.70	25,772	39,322	65,094
1946	375	1,202	1,577	72.00	37.50	45.70	27,000	45,069	72,069
1947	368	1,146	1,514	85.00	45.90	55.40	31,280	52,596	83,876
1948	342	990	1,332	100.00	57.62	68.50	34,200	57,042	91,242
1949	318	1,014	1,332	122.00	72.48	84.30	38,796	73,492	112,288
1950	331	1,108	1,439	128.00	73.84	86.30	42,368	81,818	124,186

1/ Cows and heifers 2 years and over kept for milk.

Table 9. - Cattle: Number on farms, by classes, January 1, 1920-50

Year	All cattle	Milk animals			Other animals				
		Cows 2 yrs.+	Heifers 1-2 yrs.	Heifer calves	Cows 2 yrs.+	Heifers 1-2 yrs.	Other calves	Steers 1 yrs.+	Bulls 1 yrs.+
	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head
1920	950	220	50	55	287	74	173	73	18
1921	931	225	49	54	275	71	170	69	18
1922	912	233	48	55	262	68	162	67	17
1923	902	242	47	56	248	65	164	63	17
1924	884	248	46	58	242	62	153	59	16
1925	871	253	44	63	240	60	140	55	16
1926	836	245	43	58	240	59	124	51	16
1927	819	250	43	59	230	55	123	43	16
1928	810	256	44	64	217	51	120	42	16
1929	819	253	46	61	227	50	125	40	17
1930	836	250	49	64	231	51	133	40	18
1931	869	257	53	65	238	56	135	46	19
1932	920	270	57	67	250	61	144	51	20
1933	986	280	62	73	268	69	157	56	21
1934	1,070	298	70	81	284	77	174	64	22
1935	1,125	310	73	87	292	85	187	68	23
1936	1,080	310	69	85	297	82	177	38	22
1937	1,102	316	68	88	292	88	182	46	22
1938	1,125	322	72	95	307	83	175	48	23
1939	1,148	329	79	101	286	93	191	45	24
1940	1,204	335	88	96	321	104	190	45	25
1941	1,216	335	88	97	328	111	181	51	25
1942	1,240	342	89	99	367	108	167	43	25
1943	1,351	356	91	122	405	115	183	50	29
1944	1,500	367	101	117	458	135	221	67	34
1945	1,561	379	97	114	515	141	203	78	34
1946	1,577	375	98	123	540	134	205	69	33
1947	1,514	368	93	119	525	133	185	59	32
1948	1,332	342	85	99	473	113	152	41	27
1949	1,332	318	76	107	478	117	167	43	26
1950	1,439	331	78	124	517	130	184	46	29

Table 10. - Dairy products: Production, disposition, and income, 1924-49

Year	Number of milk cows on farms 1/	Milk produced per cow	Total production on farms			Total milk used on farms 2/	Total milk utilized for products sold	Cash re-ceipts 3/	Value of home con-sumption 4/	Gross income from dairy products
			Milk	Butterfat	Butter					
	1,000 head	Pounds	Million pounds	Million pounds	1,000 pounds	Million pounds	Million pounds	1,000 dollars	1,000 dollars	1,000 dollars
1924	200	2,200	440	19	4,320	268	172	6,899	10,546	17,445
1925	201	2,200	442	19	4,500	260	182	6,780	9,512	16,292
1926	205	2,300	472	21	4,800	276	196	7,586	10,449	18,035
1927	209	2,400	502	22	5,600	297	205	7,806	11,087	18,893
1928	217	2,330	506	22	5,500	296	210	7,931	10,962	18,893
1929	220	2,450	539	24	5,816	297	242	8,668	10,418	19,086
1930	224	2,380	533	23	5,900	304	229	7,937	10,341	18,278
1931	234	2,360	552	24	6,300	321	231	6,597	8,980	15,577
1932	244	2,340	571	25	6,800	336	235	5,040	7,062	12,102
1933	254	2,290	582	26	6,700	341	241	5,188	7,202	12,390
1934	270	2,200	594	26	6,609	349	245	5,743	8,016	13,759
1935	269	2,150	578	25	6,600	349	229	5,883	8,815	14,698
1936	265	2,220	588	26	6,500	349	239	6,344	9,090	15,434
1937	266	2,250	598	26	6,500	350	248	6,848	9,494	16,342
1938	274	2,360	647	28	6,600	363	284	7,195	9,032	16,227
1939	280	2,370	664	29	6,360	376	288	7,179	9,188	16,367
1940	283	2,220	628	28	5,500	347	281	7,611	9,241	16,852
1941	286	2,250	644	29	5,300	341	303	8,643	9,548	18,191
1942	290	2,300	667	30	4,700	318	349	11,594	10,325	21,919
1943	293	2,340	686	31	4,600	323	363	14,331	12,442	26,773
1944	296	2,350	696	31	4,900	326	370	15,159	13,079	28,238
1945	296	2,340	693	31	5,700	339	354	14,781	13,836	28,617
1946	290	2,300	667	30	5,500	339	328	17,087	17,297	34,384
1947	278	2,390	664	30	5,200	315	349	21,085	18,603	39,688
1948	260	2,500	650	29	5,000	320	330	22,016	20,877	42,893
1949	258	2,600	671	30	5,300	335	336	21,040	20,408	41,448

1/ Average number on farms during year. Heifers not freshened excluded.
2/ Includes milk used as milk or cream and as farm butter, and milk fed to calves.
3/ Value of combined sales of butter, cream, and milk.
4/ Milk and milk equivalent of cream and farm butter consumed, valued at the average returns for milk utilized in dairy products sold. Does not include milk fed to calves.

Table 11. - Dairy products: Farm marketings, price, and value, 1924-49

Year	Farm butter sold			Butterfat sold to plants and dealers			Wholesale milk sold to plants and dealers			Milk and cream retailed by farmers		
	Quantity	Price per lb.	Value of sales	Quantity	Price per lb.	Value of sales	Quantity	Price per cwt.	Value of sales	Quantity	Price per qt.	Value of sales
	1,000 pounds	Cents	1,000 dollars	1,000 pounds	Cents	1,000 dollars	Million pounds	Dollars	1,000 dollars	Million quarts	Cents	1,000 dollars
1924	500	45	225	320	40	128	88	3.00	2,640	31	12.6	3,906
1925	550	44	242	280	38	106	97	2.70	2,619	31	12.3	3,813
1926	600	43	258	360	40	144	108	2.80	3,024	32	13.0	4,160
1927	700	44	308	520	41	213	111	2.70	2,997	32	13.4	4,288
1928	700	43	301	640	41	262	112	2.75	3,080	32	13.4	4,288
1929	713	42	299	960	41	394	134	2.75	3,685	33	13.0	4,290
1930	600	41	246	800	35	280	130	2.55	3,315	32	12.8	4,096
1931	600	31	186	1,280	24	307	120	2.10	2,520	32	11.2	3,584
1932	800	23	184	1,600	16	256	112	1.45	1,624	32	9.3	2,976
1933	600	22	132	1,560	16	250	122	1.50	1,830	32	9.3	2,976
1934	600	24	144	1,320	19	251	130	1.70	2,210	33	9.5	3,138
1935	600	28	168	1,320	24	317	116	1.95	2,262	32	9.8	3,136
1936	600	29	174	1,320	27	356	126	2.10	2,646	32	9.9	3,168
1937	620	30	186	1,320	29	383	134	2.25	3,015	32	10.2	3,264
1938	640	27	173	1,560	23	359	161	2.15	3,462	33	9.7	3,201
1939	635	26	165	1,600	21	336	164	2.10	3,444	33	9.8	3,234
1940	500	27	135	1,430	25	358	166	2.30	3,818	33	10.0	3,300
1941	450	31	140	1,520	30	456	190	2.45	4,655	32	10.6	3,392
1942	430	35	150	1,480	34	503	236	3.00	7,080	33	11.7	3,861
1943	370	45	166	1,100	41	451	260	3.65	9,490	33	12.8	4,224
1944	400	45	180	630	45	284	274	3.75	10,275	34	13.0	4,420
1945	500	48	240	590	47	277	259	3.80	9,842	33	13.4	4,422
1946	500	59	295	340	54	184	245	4.93	12,078	30	15.1	4,530
1947	450	64	288	340	62	211	267	5.71	15,246	30	17.8	5,340
1948	400	66	264	210	66	139	254	6.26	15,900	29	19.7	5,713
1949	420	61	256	210	59	124	260	5.76	14,976	29	19.6	5,684

Table 12. - All hogs and pigs: Number on farms, value per head, and farm value, January 1, 1909-50

Year	Number	Value per head	Farm value
	1,000 head	Dollars	1,000 dollars
1909	997	4.75	4,736
1910	1,000	5.50	5,500
1911	1,119	6.20	6,938
1912	1,125	5.80	6,525
1913	1,040	7.00	7,280
1914	950	8.00	7,600
1915	935	7.70	7,200
1916	970	7.30	7,081
1917	1,000	9.20	9,200
1918	1,020	13.60	13,872
1919	966	15.20	14,683
1920	851	14.60	12,425
1921	749	11.90	8,913
1922	700	8.80	6,160
1923	650	8.00	5,200
1924	580	7.80	4,524
1925	528	8.60	4,541
1926	496	8.80	4,365
1927	472	10.10	4,767
1928	527	9.20	4,848
1929	586	9.70	5,684
1930	637	8.80	5,606
1931	605	7.30	4,416
1932	758	6.50	4,927
1933	796	4.10	3,264
1934	796	3.90	3,123
1935	777	4.85	3,758
1936	730	7.90	5,782
1937	818	6.70	5,469
1938	834	6.50	5,424
1939	934	5.60	5,230
1940	999	4.80	4,795
1941	849	5.20	4,413
1942	815	8.50	6,950
1943	807	12.00	9,720
1944	1,049	11.10	11,597
1945	902	11.40	10,283
1946	812	14.60	11,855
1947	739	17.50	12,932
1948	724	21.70	15,711
1949	724	21.00	15,204
1950	731	16.30	11,915

Table 13. - Hogs: January 1 inventory, pig crop, and disposition, 1924-49

Year	On hand January 1	Spring		Fall		In shipments	Marketings	Farm slaughter	Deaths
		Sows farrowed	Pigs saved	Sows farrowed	Pigs saved				
	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head
1924	580	95	428	55	237	-	281	335	101
1925	528	85	434	51	285	3	302	335	117
1926	496	85	442	56	308	4	335	331	112
1927	472	89	459	59	313	5	301	310	111
1928	527	82	410	47	245	6	222	290	90
1929	586	85	442	45	243	4	277	273	88
1930	637	72	378	42	225	5	275	273	92
1931	605	80	434	68	381	3	180	375	110
1932	758	95	498	81	436	1	322	450	125
1933	796	110	560	82	430	2	442	420	130
1934	796	126	634	85	435	1	504	450	135
1935	777	118	590	80	400	2	379	450	210
1936	730	130	642	96	470	3	382	460	185
1937	818	118	590	100	500	3	407	420	250
1938	834	132	660	115	586	5	529	415	207
1939	934	140	686	117	608	7	540	445	251
1940	999	122	598	90	441	7	501	425	270
1941	849	116	580	91	455	7	436	400	240
1942	815	116	592	97	514	7	511	370	240
1943	807	145	740	125	662	18	478	420	280
1944	1,049	146	774	95	494	13	738	390	300
1945	902	124	632	97	524	1	622	375	250
1946	812	122	634	89	445	3	535	385	235
1947	739	112	582	92	488	1	546	340	200
1948	724	108	562	90	486	2	545	330	175
1949	724	119	631	94	508	1	608	320	205

Table 14. - Hogs: Production, marketings, price, and income, 1924-49

Year	Production	Marketings	Average price per 100 lbs.	Cash receipts	Value of home consumption	Gross income	Cost of in-shipments
	1,000 pounds	1,000 pounds	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1924	97,880	50,580	7.40	4,723	3,212	7,935	—
1925	103,865	54,360	8.80	5,949	3,821	9,770	46
1926	108,630	60,300	9.40	6,898	4,032	10,930	65
1927	99,595	45,150	9.20	5,281	3,696	8,977	54
1928	87,380	33,300	7.90	3,537	2,969	6,506	56
1929	89,500	41,550	7.90	4,135	2,795	6,930	56
1930	82,350	41,250	7.60	3,955	2,689	6,644	68
1931	104,180	27,000	6.10	2,551	2,965	5,516	34
1932	122,830	48,300	4.30	2,841	2,508	5,349	9
1933	136,007	66,300	3.60	2,986	1,959	4,945	15
1934	146,720	75,600	4.00	3,735	2,333	6,068	8
1935	125,325	56,850	5.80	4,383	3,341	7,724	22
1936	138,680	57,300	6.40	4,892	3,768	8,660	36
1937	132,005	65,120	6.70	5,533	3,602	9,135	37
1938	163,335	87,285	5.90	6,169	3,134	9,303	56
1939	169,780	91,800	5.30	5,847	3,019	8,866	71
1940	140,310	85,170	4.60	4,731	2,502	7,233	64
1941	132,970	76,300	7.00	6,506	3,584	10,090	89
1942	144,875	89,425	10.50	11,006	4,973	15,979	126
1943	178,355	87,580	12.20	12,816	6,558	19,374	370
1944	178,855	132,240	10.40	15,440	5,192	20,632	232
1945	163,737	114,252	12.30	16,092	6,273	22,365	21
1946	161,083	100,543	15.20	17,946	8,193	26,139	75
1947	161,460	106,300	20.70	25,206	9,853	35,059	33
1948	161,750	104,430	21.10	25,203	9,748	34,951	68
1949	168,312	113,817	17.50	22,393	7,616	30,009	28

Table 15. - All sheep including lambs: Number on farms, value per head, and farm value, January 1, 1909-50

Year	Number	Value per head	Farm value
	1,000 head	Dollars	1,000 dollars
1909	183	1.80	329
1910	185	1.90	352
1911	186	1.80	335
1912	187	2.00	374
1913	190	2.00	380
1914	195	2.20	429
1915	200	2.20	440
1916	210	2.30	483
1917	219	2.90	635
1918	225	4.10	922
1919	228	5.20	1,186
1920	230	5.40	1,242
1921	225	3.80	855
1922	225	2.80	630
1923	230	2.90	667
1924	235	3.10	728
1925	235	3.20	752
1926	235	3.00	705
1927	240	3.00	720
1928	240	3.00	720
1929	245	3.30	808
1930	250	3.40	850
1931	255	2.70	688
1932	260	2.70	702
1933	265	2.00	530
1934	270	2.20	594
1935	275	2.65	727
1936	248	3.20	788
1937	260	3.10	812
1938	268	3.05	822
1939	276	3.00	823
1940	282	3.10	881
1941	282	3.10	880
1942	296	3.95	1,166
1943	257	4.40	1,137
1944	231	4.40	1,016
1945	226	4.45	1,006
1946	226	4.45	1,006
1947	192	5.60	1,075
1948	169	5.60	946
1949	127	6.60	838
1950	140	7.90	1,106

Table 16. - Sheep and lambs: January 1 inventory, lamb crop, and disposition, 1924-49

Year	On hand Jan. 1 All sheep and lambs	Lambs saved	In-shipments		Marketings 1/		Farm slaughter		Deaths	
			Sheep	Lambs	Sheep	Lambs	Sheep	Lambs	Sheep	Lambs
	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head	1,000 head
1924	235	70	-	-	12	25	1	2	20	10
1925	235	70	2	-	24	15	1	2	20	10
1926	235	67	-	-	17	12	1	2	20	10
1927	240	76	2	-	26	20	1	1	20	10
1928	240	74	1	-	18	20	2	-	20	10
1929	245	79	1	-	18	25	-	2	20	10
1930	250	80	-	-	14	29	1	1	20	10
1931	255	73	-	-	18	17	1	2	20	10
1932	260	86	2	-	24	24	1	4	20	10
1933	265	112	-	-	22	49	2	4	20	10
1934	270	100	-	-	22	20	2	6	30	15
1935	275	80	-	-	44	21	3	5	23	11
1936	248	93	-	-	11	26	3	4	25	12
1937	260	87	-	-	14	25	3	4	24	9
1938	268	100	1	-	17	32	2	3	26	13
1939	276	101	-	1	18	37	2	3	27	9
1940	282	94	-	-	30	23	2	3	25	11
1941	282	109	-	-	18	19	2	3	31	22
1942	296	83	-	-	35	14	2	3	45	23
1943	257	76	-	-	28	14	2	3	43	12
1944	231	72	-	-	22	8	2	3	28	14
1945	226	76	-	-	11	12	2	3	33	15
1946	226	68	-	-	38	9	2	3	33	17
1947	192	63	-	-	25	15	2	3	29	12
1948	169	62	-	-	43	17	2	3	25	14
1949	127	51	4	1	1	10	2	2	19	9

1/ Excludes interfarm sales.

Table 17. - Sheep and lambs: Production, marketings, price, and income, 1924-49

Year	Net production			Marketings 1/	Price per cwt.		Cash receipts	Value of home consumption	Gross income	Cost of in-shipments
	Sheep	Lambs	Total		Sheep	Lambs				
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	Dollars	Dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
1924	970	1,450	2,420	2,330	5.10	6.60	143	7	150	-
1925	2,070	850	2,920	2,910	6.30	8.10	205	8	213	12
1926	2,090	700	2,790	2,130	5.40	7.30	133	7	140	-
1927	2,020	1,150	3,170	3,340	5.70	7.60	214	5	219	11
1928	2,260	950	3,210	2,620	6.90	8.90	207	7	214	6
1929	2,194	1,250	3,444	2,924	6.70	9.00	229	5	234	5
1930	1,695	1,600	3,295	2,752	5.70	7.30	185	5	190	-
1931	2,227	950	3,177	2,524	4.30	6.50	132	6	138	-
1932	2,245	1,600	3,845	3,432	3.40	4.15	132	6	138	5
1933	2,622	2,700	5,322	4,496	3.05	4.20	173	8	181	-
1934	2,632	1,350	3,982	3,046	3.05	3.75	109	10	119	-
1935	2,481	950	3,431	5,142	3.35	5.00	201	12	213	-
1936	1,662	1,900	3,562	2,323	3.95	5.80	128	13	141	-
1937	2,545	1,350	3,895	2,580	4.05	5.50	136	13	149	-
1938	2,175	1,900	4,075	3,215	3.80	5.60	160	8	168	3
1939	2,370	2,000	4,370	3,560	3.75	5.50	175	8	183	4
1940	2,710	1,500	4,210	4,000	4.00	5.60	187	9	196	-
1941	2,636	1,538	4,174	2,734	4.25	6.00	143	10	153	-
1942	1,375	50	1,425	4,025	5.40	7.30	243	12	255	-
1943	636	918	1,554	3,584	6.20	8.40	255	14	269	-
1944	1,862	646	2,508	2,608	6.20	8.40	187	14	201	-
1945	1,327	764	2,091	1,731	6.50	9.70	148	15	163	-
1946	1,363	333	1,696	4,246	6.90	11.00	332	16	348	-
1947	885	600	1,485	3,075	7.10	13.60	286	18	304	-
1948	914	850	1,764	5,044	8.80	15.00	524	22	546	-
1949	741	817	1,558	713	9.00	16.30	128	18	146	53

1/ Excludes interfarm sales.

Table 18. - Wool: Production, price, and value, 1909-49

Year	Sheep shorn	Weight per fleece	Production	Season average price per pound	Farm value
	1,000 head	Pounds	1,000 pounds	Cents	1,000 dollars
1909	150	3.2	480	21	101
1910	152	3.2	486	22	107
1911	153	3.7	566	16	91
1912	153	4.1	627	16	100
1913	156	3.5	546	14	76
1914	160	4.0	640	14	90
1915	164	3.7	607	15	91
1916	172	3.7	636	21	134
1917	180	3.6	648	35	227
1918	184	3.7	681	44	300
1919	187	3.3	617	37	228
1920	189	3.3	624	28	175
1921	185	3.1	574	12	69
1922	185	3.1	574	15	86
1923	188	3.1	583	20	117
1924	193	3.2	618	28	173
1925	193	3.3	637	39	248
1926	193	3.2	618	27	167
1927	200	3.3	660	26	172
1928	215	3.2	688	33	227
1929	200	3.2	640	32	205
1930	215	3.4	731	23	168
1931	210	3.6	756	13	98
1932	210	3.6	756	7	53
1933	213	3.5	746	16	119
1934	215	3.4	731	21	154
1935	234	3.3	772	20	154
1936	210	3.4	714	23	164
1937	220	3.3	726	30	218
1938	225	3.3	742	20	148
1939	235	3.3	776	21	163
1940	240	3.3	792	24	190
1941	243	3.4	826	34	281
1942	255	3.2	816	38	310
1943	221	3.2	707	42	297
1944	196	3.2	627	48	301
1945	192	3.3	634	48	304
1946	192	3.2	614	48	295
1947	163	3.4	554	43	238
1948	144	3.4	490	45	220
1949	108	3.5	378	45	170

Table 19.- Workstock: Number on farms, value per head, and farm value, January 1, 1910-50

Year	Horses			Mules		
	Number	Value per head	Farm value	Number	Value per head	Farm value
	1,000 head	Dollars	1,000 dollars	1,000 head	Dollars	1,000 dollars
1910	178	79	14,062	132	116	15,312
1911	175	83	14,525	133	119	15,827
1912	170	79	13,430	134	116	15,544
1913	170	87	14,790	135	127	17,145
1914	171	85	14,535	138	128	17,664
1915	175	83	14,525	140	125	17,500
1916	180	82	14,760	145	121	17,545
1917	195	86	16,770	165	125	20,625
1918	198	93	18,414	180	135	24,300
1919	195	97	18,915	185	145	26,825
1920	182	108	19,690	185	168	31,046
1921	174	85	14,867	187	143	26,731
1922	157	78	12,244	177	118	20,871
1923	150	72	10,742	176	113	19,856
1924	146	67	9,782	180	94	16,836
1925	143	62	8,866	180	90	16,200
1926	139	55	7,645	182	90	16,380
1927	135	49	6,615	186	79	14,694
1928	132	52	6,864	186	85	15,810
1929	130	53	6,890	192	89	17,088
1930	128	52	6,656	201	85	17,085
1931	126	46	5,796	205	74	15,170
1932	124	38	4,712	201	63	12,663
1933	123	32	3,936	197	56	11,032
1934	122	40	4,848	199	70	13,850
1935	122	45	5,515	199	84	16,618
1936	122	56	6,843	199	99	19,791
1937	123	65	7,951	197	110	21,670
1938	128	64	8,205	195	113	22,035
1939	137	60	8,220	191	111	21,201
1940	145	59	8,555	187	109	20,383
1941	146	58	8,403	183	102	18,672
1942	147	61	8,954	179	104	18,631
1943	146	69	10,103	168	118	19,756
1944	146	74	10,824	166	130	21,537
1945	145	71	10,295	161	122	19,642
1946	139	71	9,869	148	116	17,168
1947	132	68	8,976	142	117	16,614
1948	121	68	8,228	136	111	15,096
1949	115	52	5,980	126	89	11,214
1950	109	47	5,123	117	79	9,243

Table 20. - All chickens: Number on farms, value per head, and farm value, January 1, 1924-50

Year	Number	Value per head	Farm value
	1,000 head	Dollars	1,000 dollars
1924	4,370	.76	3,321
1925	4,231	.67	2,835
1926	4,400	.77	3,388
1927	5,023	.76	3,817
1928	5,009	.77	3,857
1929	4,862	.81	3,938
1930	5,510	.85	4,684
1931	5,170	.63	3,257
1932	4,872	.57	2,777
1933	4,594	.38	1,746
1934	4,608	.40	1,843
1935	4,461	.48	2,141
1936	4,586	.56	2,568
1937	5,073	.55	2,790
1938	4,689	.58	2,720
1939	5,139	.58	2,981
1940	5,562	.54	3,003
1941	5,283	.59	3,117
1942	6,105	.71	4,335
1943	6,801	.94	6,393
1944	7,259	1.15	8,348
1945	6,152	1.21	7,444
1946	6,228	1.31	8,159
1947	5,352	1.45	7,760
1948	4,858	1.45	7,044
1949	5,000	1.55	7,750
1950	4,953	1.40	6,934

Table 23. - Turkeys: Number on farms, value per head, and farm value, January 1, 1929-50

Year	Number	Value per head	Farm value
	1,000 head	Dollars	1,000 dollars
1929	21	5.10	107
1930	23	3.75	86
1931	24	2.80	67
1932	28	1.90	53
1933	34	1.40	48
1934	34	1.45	49
1935	32	2.05	66
1936	38	2.65	101
1937	38	2.40	91
1938	38	2.50	95
1939	32	2.50	80
1940	40	2.30	92
1941	34	2.40	82
1942	28	3.10	87
1943	23	3.90	90
1944	22	5.10	112
1945	18	5.30	95
1946	18	6.00	108
1947	17	6.20	105
1948	17	6.50	110
1949	14	7.40	104
1950	15	6.20	93

Table 24. - Eggs: Production, disposition, price, and value, 1924-49

Year	Number			Price per dozen	Value of		Value of production 1/
	Produced	consumed on farms	sold from farms		home consumption	sales	
	Million	Million	Million	Cents	1,000 dollars	1,000 dollars	1,000 dollars
1924	261	122	125	26.8	2,725	2,792	5,829
1925	257	118	126	29.6	2,911	3,108	6,339
1926	289	130	144	28.6	3,098	3,432	6,888
1927	288	134	139	25.2	2,814	2,919	6,048
1928	312	140	158	27.4	3,197	3,608	7,124
1929	299	132	152	28.2	3,102	3,572	7,026
1930	282	134	132	25.4	2,836	2,794	5,969
1931	272	139	119	17.7	2,050	1,755	4,012
1932	243	143	86	13.2	1,573	946	2,673
1933	241	136	91	13.3	1,507	1,009	2,671
1934	225	132	80	16.2	1,782	1,080	3,038
1935	236	124	100	21.2	2,191	1,767	4,169
1936	240	128	100	21.1	2,151	1,758	4,220
1937	271	136	123	20.5	2,323	2,101	4,630
1938	292	148	133	18.0	2,220	1,995	4,380
1939	311	145	155	16.8	2,030	2,170	4,354
1940	284	130	143	16.8	1,820	2,002	3,976
1941	303	122	169	21.9	2,226	3,084	5,530
1942	349	123	215	27.4	2,808	4,909	7,969
1943	390	129	248	35.3	3,795	7,295	11,473
1944	414	125	277	31.7	3,302	7,317	10,937
1945	383	125	245	36.7	3,823	7,493	11,713
1946	328	128	191	39.0	4,160	6,208	10,660
1947	303	128	167	46.3	4,939	6,443	11,691
1948	313	123	182	47.6	4,879	7,219	12,415
1949	331	130	193	45.6	4,940	7,334	12,578

1/ Gross income plus value of eggs used for farm hatching.

Table 25.- Honey bees: Number of colonies, production, price, and value of honey and of beeswax, 1939-49

Year	Colonies of bees	Production		Season average price		Value of production	
		Honey	Beeswax	All honey	Beeswax	Honey	Beeswax
	1,000 colonies	1,000 pounds	1,000 pounds	Cents per pound	Cents per pound	1,000 dollars	1,000 dollars
1939	57	1,254	-	-	-	-	-
1940	60	1,020	-	-	-	-	-
1941	52	1,300	24	-	29.0	-	-
1942	56	1,008	19	10.5	40.3	106	8
1943	62	1,860	32	13.4	42.8	249	14
1944	68	1,564	42	16.0	42.0	250	18
1945	75	1,575	39	16.8	40.0	265	16
1946	81	1,215	30	17.5	46.0	213	14
1947	87	1,914	42	16.8	45.0	322	19
1948	96	1,920	40	13.1	44.0	252	18
1949	101	2,020	32	13.2	40.0	267	13

Table 26.- Package bees: Colonies for production of package bees, package bees shipped, and queen bees shipped, 1944-49

Year	Colonies held for production of package bees	Total pounds of package bees shipped	Queen bees shipped
	Number	Pounds	Number
1944	-	178,000	177,000
1945	27,600	196,000	170,800
1946	31,700	206,000	170,000
1947	33,300	243,000	188,700
1948	33,300	216,000	141,500
1949	30,000	136,100	134,400

Table 27. - Cotton lint: Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production 500 lb. bales 1/	Season Average price per pound	Farm value
	1,000 acres	Pounds	1,000 bales	Cents	1,000 dollars
1909	931	130	253	13.38	16,953
1910	870	135	246	14.00	17,195
1911	938	196	385	9.63	18,518
1912	922	195	376	11.38	21,400
1913	1,117	190	444	12.23	27,140
1914	1,220	176	449	7.64	17,169
1915	916	178	341	10.94	18,656
1916	1,127	188	443	16.82	37,272
1917	1,252	244	639	26.39	84,280
1918	1,441	195	588	28.54	83,867
1919	1,304	109	298	35.78	53,255
1920	1,243	149	388	16.80	32,564
1921	1,009	132	279	15.85	22,099
1922	1,032	159	343	22.50	38,618
1923	1,255	140	368	27.70	50,952
1924	1,427	165	493	22.05	54,315
1925	1,727	252	910	19.28	87,769
1926	1,802	220	829	12.47	51,714
1927	1,448	181	548	19.94	54,638
1928	1,836	180	691	17.77	61,392
1929	1,934	200	809	16.45	66,526
1930	1,953	175	715	9.33	33,333
1931	1,825	236	900	5.57	25,063
1932	1,688	173	611	6.74	20,574
1933	1,295	176	477	10.24	24,404
1934	1,189	195	485	12.46	30,195
1935	1,268	210	556	10.97	30,512
1936	1,401	260	761	12.44	47,343
1937	1,569	337	1,104	8.40	46,352
1938	1,119	289	676	8.55	28,904
1939	1,120	319	745	9.02	33,584
1940	1,130	194	456	9.70	22,093
1941	1,014	148	313	17.19	26,886
1942	1,001	285	593	18.76	55,602
1943	982	362	739	19.54	72,172
1944	884	338	620	20.78	64,387
1945	804	232	387	22.60	43,698
1946	800	148	247	33.16	40,949
1947	850	285	505	32.43	81,782
1948	950	382	756	31.24	118,013
1949	1,050	298	650	29.10	94,645

1/ Gross weight.

Table 28. - Cottonseed: Yield, production, price, and value, 1909-49

Year	Yield per acre	Production	Season average price per ton	Farm value
	Pounds	1,000 tons	Dollars	1,000 dollars
1909	241	112	22.70	2,542
1910	251	109	25.64	2,795
1911	365	171	18.03	3,083
1912	362	167	18.79	3,138
1913	353	197	18.74	3,692
1914	326	199	15.26	3,037
1915	330	151	27.26	4,116
1916	350	197	42.83	8,438
1917	454	284	60.94	17,307
1918	362	261	64.69	16,884
1919	202	132	64.48	8,511
1920	277	172	29.07	5,000
1921	246	124	27.39	3,396
1922	295	152	28.12	4,274
1923	260	163	40.35	6,577
1924	307	219	31.18	6,828
1925	468	404	30.68	12,395
1926	408	368	21.25	7,820
1927	336	243	32.77	7,963
1928	355	326	31.76	10,354
1929	389	376	29.60	11,130
1930	338	330	21.28	7,022
1931	456	416	7.67	3,191
1932	344	290	10.11	2,932
1933	344	223	12.20	2,721
1934	378	225	31.78	7,150
1935	396	251	30.35	7,618
1936	498	349	33.77	11,786
1937	579	454	18.79	8,531
1938	497	278	20.58	5,721
1939	543	304	19.24	5,849
1940	338	191	20.32	3,881
1941	266	135	47.54	6,418
1942	486	243	44.44	10,799
1943	609	299	51.60	15,428
1944	566	250	50.20	12,550
1945	405	163	49.80	8,117
1946	258	103	61.90	6,376
1947	473	201	79.80	16,040
1948	636	302	66.70	20,143
1949	503	264	42.10	11,114

Table 29. - Rice: Acreage, yield, production, price, and value, 1909-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1909	370	34.1	12,617	.77	9,715
1910	360	37.0	13,320	.65	8,658
1911	350	33.5	11,725	.78	9,146
1912	315	35.5	11,182	.88	9,840
1913	350	32.0	11,200	.87	9,744
1914	320	36.0	11,520	.89	10,253
1915	385	33.5	12,898	.81	10,447
1916	435	46.0	20,010	.95	19,010
1917	485	33.0	16,005	1.89	30,249
1918	565	32.0	18,080	1.73	31,278
1919	543	35.0	19,005	2.49	47,322
1920	676	37.0	25,012	1.13	28,264
1921	549	33.7	18,501	.96	17,761
1922	555	34.8	19,314	.95	18,348
1923	474	33.5	15,879	1.09	17,308
1924	430	35.0	15,050	1.32	19,866
1925	414	34.2	14,159	1.49	21,097
1926	492	33.0	16,236	1.11	18,022
1927	520	38.1	19,812	.92	18,227
1928	495	38.1	18,860	.94	17,728
1929	465	40.5	18,832	1.00	18,832
1930	491	39.0	19,149	.77	14,745
1931	458	35.0	16,030	.52	8,336
1932	415	39.5	16,392	.43	7,049
1933	395	41.0	16,195	.78	12,632
1934	415	40.4	16,766	.82	13,748
1935	412	42.0	17,296	.71	12,280
1936	479	44.0	21,076	.90	18,968
1937	517	40.0	20,680	.69	14,269
1938	494	42.0	20,748	.65	13,486
1939	485	44.0	21,340	.74	15,792
1940	469	40.0	18,760	.85	15,946
1941	544	37.5	20,400	1.33	27,132
1942	615	38.0	23,370	1.62	37,859
1943	603	36.0	21,708	1.81	39,291
1944	561	38.0	21,318	1.79	38,159
1945	583	39.5	23,028	1.83	42,141
1946	589	38.5	22,676	2.31	52,382
1947	613	36.0	22,068	2.58	56,935
1948	631	39.5	24,924	2.19	54,584
1949	599	41.0	24,559	1.86	45,680

Table 30. - Sugarcane (for sugar and seed): Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per ton 1/	Farm value
	1,000 acres	Tons	1,000 tons	Dollars	1,000 dollars
1909	313	15.0	4,698	3.83	17,993
1910	326	17.0	5,537	3.69	20,432
1911	336	19.0	6,375	4.29	27,349
1912	255	11.0	2,807	3.73	10,470
1913	284	17.0	4,834	3.13	15,130
1914	250	15.0	3,758	3.75	14,092
1915	238	11.0	2,623	4.55	11,935
1916	259	18.3	4,749	5.29	25,122
1917	285	15.7	4,465	7.10	31,702
1918	263	18.0	4,738	7.28	34,493
1919	233	10.5	2,455	14.00	34,370
1920	247	13.6	3,361	5.76	19,359
1921	272	18.5	5,033	3.63	18,270
1922	295	15.6	4,600	5.83	26,818
1923	286	11.1	3,171	7.09	22,482
1924	251	7.6	1,900	5.58	10,602
1925	236	14.0	3,293	4.05	13,337
1926	161	6.8	1,088	4.92	5,353
1927	89	13.1	1,168	4.61	5,384
1928	146	14.4	2,099	3.86	8,102
1929	198	15.9	3,140	3.77	11,838
1930	191	14.6	2,793	3.38	9,440
1931	186	13.2	2,463	3.29	8,103
1932	229	13.8	3,167	3.06	9,691
1933	219	13.2	2,892	3.29	9,515
1934	247	13.6	3,365	2.33	7,840
1935	261	17.1	4,457	3.18	14,173
1936	247	21.3	5,271	3.71	19,555
1937	287	19.9	5,702	2.91	16,593
1938	288	21.7	6,250	2.66	16,625
1939	256	21.5	5,499	2.88	15,837
1940	240	13.6	3,258	2.72	8,862
1941	257	17.5	4,498	3.94	17,722
1942	295	17.5	5,177	4.35	22,520
1943	278	20.8	5,773	4.60	26,556
1944	266	20.0	5,310	4.98	26,444
1945	258	21.9	5,642	5.58	31,482
1946	278	17.6	4,893	6.55	32,049
1947	285	15.2	4,332	7.24	31,364
1948	298	19.2	5,722	5.88	33,645
1949	300	18.8	5,640	5.93	33,445

1/ Does not include benefit payments.

Table 31. - Sugarcane (for sugar): Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per ton 1/	Farm value
	1,000 acres	Tons	1,000 tons	Dollars	1,000 dollars
1909	282	15.0	4,229	3.83	16,197
1910	300	16.8	5,046	3.69	18,620
1911	310	19.0	5,887	4.29	25,255
1912	197	11.0	2,163	3.73	8,068
1913	248	17.0	4,214	3.13	13,190
1914	213	15.0	3,199	3.75	11,996
1915	183	11.0	2,018	4.55	9,182
1916	221	18.4	4,072	5.29	21,541
1917	244	15.6	3,813	7.10	27,072
1918	231	18.1	4,170	7.28	30,358
1919	179	10.5	1,883	14.00	26,362
1920	183	13.6	2,493	5.76	14,360
1921	226	18.5	4,181	3.63	15,177
1922	242	15.6	3,778	5.83	22,026
1923	215	11.1	2,387	7.09	16,924
1924	163	7.5	1,228	5.58	6,852
1925	190	13.9	2,644	4.05	10,708
1926	128	6.8	864	4.92	4,251
1927	73	13.2	962	4.61	4,435
1928	130	14.3	1,860	3.86	7,180
1929	185	15.8	2,918	3.77	11,001
1930	175	14.6	2,559	3.38	8,649
1931	169	13.2	2,232	3.29	7,343
1932	208	13.9	2,886	3.06	8,831
1933	197	13.2	2,600	3.29	8,554
1934	222	13.6	3,019	2.33	7,034
1935	239	17.1	4,087	3.18	12,997
1936	227	21.4	4,854	3.71	18,008
1937	265	19.8	5,247	2.91	15,269
1938	270	21.7	5,859	2.66	15,585
1939	236	21.5	5,069	2.88	14,599
1940	209	13.7	2,864	2.72	7,790
1941	225	17.5	3,938	3.94	15,516
1942	270	17.6	4,752	4.35	20,671
1943	259	20.8	5,387	4.60	24,780
1944	246	20.0	4,920	4.98	24,502
1945	239	21.9	5,234	5.58	29,206
1946	255	17.6	4,488	6.55	29,396
1947	258	15.2	3,922	7.24	28,395
1948	274	19.2	5,261	5.88	30,935
1949	277	18.8	5,208	5.93	30,883

1/ Does not include benefit payments.

Table 32. - Sugarcane (for sirup): Acreage, yield, production, price, and value of sirup, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per gallon	Farm value
	1,000 acres	Gallons	1,000 gallons	Cents	1,000 dollars
1909	17.7	233	4,125	40	1,650
1910	25.0	260	6,512	44	2,865
1911	32.5	229	7,443	44	3,275
1912	39.0	215	8,400	41	3,444
1913	38.0	217	8,260	43	3,552
1914	29.0	240	6,950	43	2,988
1915	30.0	244	7,310	48	3,509
1916	38.0	218	8,266	55	4,546
1917	45.8	222	10,159	59	5,994
1918	65.8	227	14,959	68	10,172
1919	22.0	183	4,020	107	4,301
1920	19.0	244	4,634	96	4,449
1921	19.0	335	6,357	54	3,433
1922	23.0	282	6,485	49	3,178
1923	29.0	232	6,720	59	3,965
1924	52.0	194	10,068	43	4,329
1925	25.0	262	6,541	35	2,289
1926	34.0	133	4,516	41	1,852
1927	15.0	319	4,787	44	2,106
1928	23.0	290	6,679	37	2,471
1929	20.0	289	5,773	41	2,367
1930	26.0	239	6,208	36	2,235
1931	21.0	216	4,545	39	1,773
1932	19.0	192	3,650	34	1,241
1933	24.0	227	5,458	33	1,801
1934	27.0	233	6,291	37	2,328
1935	25.0	256	6,400	40	2,560
1936	24.0	285	6,840	36	2,462
1937	26.0	283	7,358	41	3,017
1938	26.0	255	6,630	38	2,519
1939	29.0	291	8,439	35	2,954
1940	26.0	220	5,720	40	2,288
1941	24.0	260	6,240	56	3,494
1942	24.0	240	5,760	62	3,571
1943	29.0	275	7,975	74	5,902
1944	29.0	230	6,670	66	4,402
1945	45.0	335	15,075	74	11,156
1946	43.0	275	11,825	120	14,190
1947	36.0	235	8,460	80	6,768
1948	11.0	200	2,200	80	1,760
1949	10.0	260	2,600	70	1,820

Table 33. - Sorghum (for sirup): Acreage, yield, production, price, and value, 1929-49

Year	Acreage harvested	Yield per acre	Production	Average price December 1	Farm value
	Acres	Gallons	Gallons	Cents	Dollars
1929	1,000	60	60,000	70	42,000
1930	1,000	46	46,000	70	32,000
1931	2,000	54	108,000	41	44,000
1932	2,000	40	80,000	36	29,000
1933	2,000	72	144,000	38	55,000
1934	2,000	45	90,000	45	40,000
1935	2,000	38	76,000	39	30,000
1936	2,000	49	98,000	40	39,000
1937	2,000	54	108,000	38	41,000
1938	2,000	46	92,000	37	34,000
1939	2,000	45	90,000	41	37,000
1940	2,000	55	110,000	39	43,000
1941	2,000	48	96,000	50	48,000
1942	11,000	68	748,000	55	411,000
1943	3,000	40	120,000	80	96,000
1944	2,000	55	110,000	85	94,000
1945	2,000	60	120,000	90	108,000
1946	2,000	40	80,000	135	108,000
1947	2,000	35	70,000	140	98,000
1948	2,000	43	86,000	95	82,000
1949	2,000	45	90,000	100	90,000

Table 34. - Corn: Acreage planted with hybrid seed, 1938-49

Year	All corn (planted acreage)	Percentage planted with hybrid seed	Indicated hybrid corn acreage
	1,000 acres		1,000 acres
1938	1,733	1/	-
1939	1,733	.2	4
1940	1,594	.4	6
1941	1,482	1.1	16
1942	1,334	1.5	23
1943	1,307	2.1	27
1944	1,229	3.7	45
1945	1,106	4.8	53
1946	1,040	8.0	83
1947	990	15.0	148
1948	955	17.5	167
1949	834	23.5	196

1/ Less than one-tenth of one percent.

Table 35. - Corn: Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1909	1,592	16.4	26,109	.74	19,321
1910	1,700	18.0	30,600	.62	18,972
1911	1,700	15.0	25,500	.76	19,380
1912	1,560	16.0	24,960	.73	18,221
1913	1,600	17.0	27,200	.82	22,304
1914	1,620	15.5	25,110	.87	21,846
1915	1,660	17.0	28,220	.72	20,318
1916	1,560	17.0	26,520	1.13	29,968
1917	1,600	14.5	23,200	1.62	37,584
1918	1,600	13.0	20,800	1.72	35,776
1919	1,523	14.5	22,084	1.73	38,205
1920	1,462	18.0	26,316	.99	26,053
1921	1,580	17.5	27,650	.72	19,908
1922	1,375	16.0	22,000	.94	20,680
1923	1,278	14.0	17,892	1.09	19,502
1924	1,250	11.0	13,750	1.22	16,775
1925	1,225	16.0	19,600	1.01	19,796
1926	1,127	15.5	17,468	.90	15,721
1927	1,161	16.0	18,576	.99	18,390
1928	1,242	15.0	18,630	.98	18,257
1929	1,190	15.8	18,802	.95	17,862
1930	1,190	11.0	13,090	.89	11,650
1931	1,368	16.0	21,888	.44	9,631
1932	1,505	14.2	21,371	.44	9,403
1933	1,429	13.0	18,577	.63	11,704
1934	1,596	9.6	15,322	.91	13,943
1935	1,628	16.0	26,048	.71	18,494
1936	1,547	13.5	20,884	.96	20,049
1937	1,485	17.5	25,988	.66	17,152
1938	1,693	16.5	27,934	.52	14,526
1939	1,647	14.0	23,058	.64	14,757
1940	1,548	15.0	23,220	.65	15,093
1941	1,440	14.0	20,160	.83	16,733
1942	1,296	17.0	22,032	.99	21,812
1943	1,270	16.0	20,320	1.35	27,432
1944	1,168	14.0	16,352	1.39	22,729
1945	1,075	19.5	20,962	1.39	29,137
1946	1,000	15.0	15,000	1.79	26,850
1947	960	14.5	13,920	2.20	30,624
1948	922	18.5	17,057	1.58	26,950
1949	802	23.0	18,446	1.30	23,980

Table 38.- Lespedeza hay: Acreage, yield, and production, 1924-49

Year	Acreage harvested	Yield per acre	Production
	1,000 acres	Tons	1,000 tons
1924	41	.65	27
1925	29	.85	25
1926	32	1.00	32
1927	24	1.30	31
1928	23	1.25	29
1929	24	1.25	30
1930	25	1.00	25
1931	29	1.20	35
1932	27	1.00	27
1933	30	1.10	33
1934	33	1.15	38
1935	37	1.25	46
1936	49	1.30	64
1937	45	1.10	50
1938	40	1.05	42
1939	56	1.25	70
1940	70	1.40	98
1941	80	1.30	104
1942	85	1.30	110
1943	88	1.00	88
1944	117	1.15	135
1945	116	1.40	162
1946	109	1.40	153
1947	108	1.10	119
1948	115	1.05	121
1949	104	1.45	151

Table 39.- Annual legume hay: Acreage, yield, and production, 1919-49

Year	Acreage harvested				Yield per acre	Production
	Soybeans	Cowpeas	Peanuts	Total		
	1,000 acres	1,000 acres	1,000 acres	1,000 acres	Tons	1,000 tons
1919	-	-	-	85	1.20	102
1920	-	-	-	85	1.25	106
1921	-	-	-	94	1.05	99
1922	-	-	-	108	1.05	113
1923	-	-	-	119	1.10	131
1924	32	72	7	111	.85	94
1925	31	65	7	103	.94	97
1926	44	45	8	97	1.07	104
1927	52	57	11	120	1.18	142
1928	53	51	9	113	1.35	153
1929	70	29	10	109	1.15	125
1930	76	43	10	129	.94	121
1931	61	49	15	125	1.27	159
1932	60	80	23	163	1.08	176
1933	72	64	20	156	1.04	163
1934	57	92	20	169	.90	152
1935	59	89	18	166	.98	162
1936	54	78	15	147	.91	134
1937	66	70	13	149	1.04	155
1938	84	64	15	163	1.05	171
1939	86	50	19	155	1.15	178
1940	82	44	19	145	1.05	152
1941	89	38	18	145	1.03	150
1942	70	26	24	120	1.07	128
1943	62	20	28	110	.99	109
1944	34	18	8	60	1.08	65
1945	36	12	6	54	1.20	65
1946	47	12	5	64	1.20	77
1947	38	12	6	56	1.14	64
1948	39	13	5	57	1.05	60
1949	35	13	4	52	1.12	58

Table 40. - Miscellaneous hay: Acreage, yield, and production, 1929-49

Year	Acreage harvested	Yield per acre	Production
	1,000 acres	Tons	1,000 tons
1929	58	1.24	72
1930	52	.98	51
1931	65	1.52	99
1932	64	1.08	69
1933	74	1.27	94
1934	102	1.09	111
1935	76	1.01	77
1936	75	1.11	83
1937	64	1.30	83
1938	59	1.17	69
1939	63	1.29	81
1940	68	1.10	75
1941	79	1.29	102
1942	74	1.09	81
1943	104	1.19	124
1944	109	1.19	130
1945	120	1.25	150
1946	117	1.09	128
1947	123	1.15	141
1948	111	1.10	122
1949	122	1.30	159

Table 41. - Tung nuts: Production, price, and value, 1939-49

Year	Production 1/	Season average price per ton	Farm value
	Tons	Dollars	1,000 dollars
1939	150	39.00	6
1940	1,200	55.00	66
1941	1,800	91.00	164
1942	4,000	87.00	348
1943	3,260	100.00	326
1944	7,550	103.00	778
1945	10,750	101.00	1,086
1946	15,200	90.00	1,368
1947	15,500	64.00	992
1948	14,000	50.00	700
1949	17,000	61.00	1,037

1/ Includes small quantities of tung nuts produced in Texas.

Table 42. - Oats: Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Cents	1,000 dollars
1909	30	17.0	510	65	332
1910	35	21.0	735	56	412
1911	36	16.0	576	62	357
1912	30	19.0	570	59	336
1913	36	20.0	720	56	403
1914	40	23.0	920	62	570
1915	60	21.0	1,260	64	806
1916	56	18.5	1,036	61	632
1917	52	19.0	988	90	889
1918	51	21.5	1,096	105	1,151
1919	50	20.0	1,000	105	1,050
1920	35	23.0	805	109	877
1921	27	23.0	621	62	385
1922	24	23.5	564	61	344
1923	25	19.0	475	66	314
1924	17	19.0	323	70	226
1925	14	21.5	301	69	208
1926	12	28.0	336	61	205
1927	11	16.5	182	64	116
1928	15	26.0	390	72	281
1929	15	25.5	382	68	260
1930	14	24.0	336	57	192
1931	31	29.0	899	37	333
1932	25	16.0	400	30	120
1933	22	16.5	363	45	163
1934	32	24.0	768	62	476
1935	57	22.5	1,282	49	628
1936	46	28.0	1,288	54	696
1937	52	33.0	1,716	51	875
1938	57	27.0	1,539	37	569
1939	60	32.0	1,920	40	768
1940	78	32.5	2,535	42	1,065
1941	86	29.5	2,537	47	1,192
1942	100	29.0	2,900	58	1,682
1943	132	28.0	3,696	88	3,252
1944	152	29.0	4,408	98	4,320
1945	131	28.0	3,668	85	3,118
1946	110	24.0	2,640	116	3,062
1947	124	27.0	3,348	114	3,817
1948	112	32.0	3,584	106	3,799
1949	101	29.0	2,929	90	2,636

Table 43. - White clover seed: Acreage, yield, production, price, and value, 1930-49

Year	Acreage harvested	Yield per acre	Production	Season average price per cwt.	Farm value
	Acres	Pounds*	Pounds*	Dollars*	Dollars
1930			900,000	23.00	207,000
1931			750,000	17.60	132,000
1932			600,000	16.65	100,000
1933			900,000	12.50	112,000
1934			900,000	16.00	144,000
1935			300,000	13.10	39,000
1936	10,000	50	500,000	15.00	75,000
1937	8,600	35	300,000	18.20	55,000
1938	6,700	30	200,000	26.50	53,000
1939	6,200	50	310,000	30.00	93,000
1940	8,100	40	320,000	38.80	124,000
1941	9,500	36	340,000	51.15	174,000
1942	11,400	45	510,000	47.50	242,000
1943	11,800	61	720,000	49.50	356,000
1944	11,800	40	470,000	59.00	277,000
1945	8,600	35	300,000	68.00	204,000
1946	8,000	40	320,000	74.00	237,000
1947	12,000	60	720,000	43.50	313,000
1948	11,000	65	720,000	47.50	342,000
1949	7,000	60	420,000	76.00	319,000

*Clean seed basis.

Table 44. - Lespedeza seed: Acreage, yield, production, price, and value, 1924-49

Year	Acreage harvested	Yield per acre	Production	Season average price per cwt.	Farm value
	Acres	Pounds	1,000 Pounds	Dollars	1,000 dollars
1924	12,000	100	1,200	18.30	220
1925	14,000	125	1,750	16.30	285
1926	12,000	140	1,680	13.60	228
1927	5,400	130	702	9.80	69
1928	5,000	130	650	13.70	89
1929	4,500	85	382	15.40	59
1930	4,800	80	384	13.90	53
1931	4,200	140	588	11.30	66
1932	3,700	115	426	7.50	32
1933	3,500	100	350	5.10	18
1934	3,400	125	425	8.50	36
1935	2,900	80	232	9.80	23
1936	3,700	115	426	13.20	56
1937	3,000	100	300	6.90	21
1938	2,500	95	238	7.80	19
1939	5,400	110	594	9.40	56
1940	7,100	120	852	9.80	83
1941	9,000	140	1,300	14.90	194
1942	11,000	130	1,400	15.60	218
1943	7,000	110	770	30.50	235
1944	12,000	145	1,700	22.60	384
1945	10,000	145	1,400	21.20	297
1946	8,000	140	1,100	26.50	292
1947	3,000	120	360	30.00	108
1948	3,500	130	460	30.20	139
1949	2,500	120	300	25.70	77

Table 45. - Cowpeas (for peas): Acreage, yield, production, price, and value, 1924-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1924	32	7.5	240	3.75	900
1925	33	9.5	314	3.55	1,115
1926	23	8.0	184	2.70	497
1927	30	10.0	300	2.41	723
1928	22	9.0	198	2.69	533
1929	25	6.0	150	2.82	423
1930	33	3.5	116	2.42	281
1931	43	4.5	194	1.35	262
1932	51	4.8	245	1.14	279
1933	54	4.0	216	1.61	348
1934	71	3.6	256	1.95	499
1935	62	4.3	267	1.76	470
1936	64	3.3	211	1.98	418
1937	64	3.2	205	1.64	336
1938	66	3.0	198	1.47	291
1939	58	4.1	238	1.35	321
1940	63	4.5	284	1.47	417
1941	65	4.0	260	2.03	528
1942	54	4.5	243	2.46	598
1943	44	5.5	242	3.28	794
1944	33	5.5	182	3.34	608
1945	29	5.0	145	3.45	500
1946	25	5.0	125	4.30	538
1947	26	5.0	130	4.77	620
1948	29	5.0	145	4.31	625
1949	30	5.5	165	3.70	610

Table 46. - Cowpeas (for peas): Production, disposition, price, and value, 1924-49

Year	Production	Farm disposition					Season average price per bushel	Value of production	Value of home consumption	Value of sales
		Used for seed		Fed to livestock	For farm household use	Sold				
		Total	On farms where grown							
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars	1,000 dollars
1924	240	90	45	84	30	81	3.75	900	112	304
1925	314	72	43	110	30	131	3.55	1,115	106	465
1926	184	96	38	80	29	37	2.70	497	78	100
1927	300	89	36	165	29	70	2.41	723	70	169
1928	198	58	47	65	38	48	2.69	533	102	129
1929	150	74	50	52	26	22	2.82	423	73	62
1930	116	94	58	30	19	9	2.42	281	46	22
1931	194	133	99	54	25	16	1.35	262	34	22
1932	245	129	96	71	29	49	1.14	279	33	56
1933	216	146	102	60	28	26	1.61	348	45	42
1934	256	131	107	69	31	49	1.95	499	60	96
1935	267	208	99	85	32	51	1.76	470	56	90
1936	211	229	102	61	27	21	1.98	418	53	42
1937	205	242	98	55	27	25	1.64	336	44	41
1938	198	226	85	55	28	30	1.47	291	41	44
1939	238	207	108	60	31	39	1.35	321	42	53
1940	284	206	109	85	28	62	1.47	417	41	91
1941	260	176	79	78	36	67	2.03	528	73	136
1942	243	134	91	78	29	45	2.46	598	71	111
1943	242	106	78	77	36	51	3.28	794	118	167
1944	182	65	39	50	25	68	3.34	608	84	227
1945	145	58	38	51	22	34	3.45	500	76	117
1946	125	50	38	40	18	29	4.30	538	77	125
1947	130	55	43	39	20	28	4.77	620	95	134
1948	145	60	46	46	22	31	4.31	625	95	134
1949	165	62	46	50	25	44	3.70	610	92	163

Table 47. - Velvet Beans: Acreage, yield, production, price, and value, 1924-49

Year	Acreage harvested	Yield per acre	Production	Season average price per ton	Farm value
	1,000 Acres	Pounds	1,000 tons	Dollars	1,000 dollars
1924	40	1,000	20	17.60	352
1925	41	850	17	17.40	296
1926	36	1,000	18	18.20	328
1927	35	1,050	18	16.80	302
1928	37	1,100	20	15.80	316
1929	38	1,000	19	16.00	304
1930	37	700	13	16.00	208
1931	41	850	17	11.20	190
1932	45	750	17	8.00	136
1933	49	900	22	14.00	308
1934	57	900	26	17.00	442
1935	58	800	23	16.10	370
1936	66	750	25	18.90	472
1937	68	720	24	18.00	432
1938	64	650	21	18.00	378
1939	78	770	30	16.40	492
1940	89	700	31	18.00	558
1941	97	800	39	20.00	780
1942	89	710	32	21.00	672
1943	90	610	27	25.00	675
1944	41	700	14	28.00	392
1945	30	760	11	29.00	319
1946	27	600	8	35.00	280
1947	27	575	8	35.00	280
1948	16	650	5	35.00	175
1949	16	725	6	35.00	210

Table 48. - Soybeans (for beans): Acreage, yield, production, price, and value, 1924-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1924	8	8.0	64	3.33	213
1925	12	10.0	120	3.57	428
1926	18	8.5	153	2.86	438
1927	21	9.0	189	2.78	525
1928	17	7.5	128	2.99	383
1929	21	10.5	220	3.16	695
1930	16	10.5	168	2.73	459
1931	12	11.0	132	1.78	235
1932	10	11.0	110	1.34	147
1933	7	12.0	84	2.01	169
1934	8	11.0	88	2.54	224
1935	9	12.5	112	1.99	223
1936	20	13.0	260	2.15	559
1937	12	12.0	144	1.41	203
1938	14	12.0	168	1.36	228
1939	16	13.5	216	1.18	255
1940	15	13.5	202	1.46	295
1941	16	11.5	184	1.97	362
1942	72	12.5	900	1.89	1,701
1943	33	11.5	380	2.80	1,064
1944	23	12.0	276	2.83	781
1945	23	14.0	322	2.65	853
1946	27	13.0	351	3.01	1,057
1947	24	12.5	300	3.33	999
1948	35	14.0	490	2.64	1,294
1949	25	15.0	375	2.50	938

Table 49. - Soybeans (for beans): Production, disposition, price, and value, 1924-49

Year	Production	Farm disposition				Season average price per bushel	Value of production	Value of sales
		Used for seed		Fed to livestock	Sold			
		Total	On farms where grown					
	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	1,000 bushels	Dollars	1,000 dollars	1,000 dollars
1924	64	32	6	16	42	3.33	213	140
1925	120	48	10	22	88	3.57	428	314
1926	153	61	12	25	116	2.86	438	332
1927	189	67	13	30	146	2.78	525	406
1928	128	84	17	22	89	2.99	383	266
1929	220	66	28	44	148	3.16	695	468
1930	168	58	24	50	94	2.73	459	257
1931	132	58	22	40	70	1.78	235	125
1932	110	60	22	38	50	1.34	147	67
1933	84	54	19	34	31	2.01	169	62
1934	88	55	20	35	33	2.54	224	84
1935	112	136	51	34	27	1.99	223	54
1936	260	154	56	39	165	2.15	559	355
1937	144	175	62	36	46	1.41	203	65
1938	168	222	67	42	59	1.36	228	80
1939	216	225	49	54	113	1.18	255	133
1940	202	297	103	40	59	1.46	295	86
1941	184	289	69	28	87	1.97	362	171
1942	900	324	211	72	617	1.89	1,701	1,166
1943	380	230	115	57	208	2.80	1,064	582
1944	276	233	58	14	204	2.83	781	577
1945	322	237	47	52	223	2.65	853	591
1946	351	245	61	56	234	3.01	1,057	704
1947	300	212	30	42	228	3.33	999	759
1948	490	187	37	60	393	2.64	1,294	1,038
1949	375	201	40	38	297	2.50	938	742

Table 50. - Peanuts (picked and threshed): Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per pound	Farm value
	1,000 acres	Pounds	1,000 pounds	Cents	1,000 dollars
1909	5	600	3,000	3.4	102
1910	4	700	2,800	3.6	101
1911	5	725	3,625	4.1	149
1912	4	700	2,800	3.5	98
1913	4	725	2,900	4.1	119
1914	5	750	3,750	4.3	161
1915	6	775	4,650	4.9	228
1916	8	600	4,800	4.8	230
1917	9	650	5,850	6.3	369
1918	8	550	4,400	6.8	299
1919	6	625	3,750	9.6	360
1920	7	600	4,200	6.5	273
1921	8	550	4,400	6.4	282
1922	8	550	4,400	6.4	282
1923	8	450	3,600	7.3	263
1924	6	355	2,130	6.3	134
1925	5	550	2,750	6.1	168
1926	6	500	3,000	6.8	204
1927	9	550	4,950	7.4	366
1928	7	450	3,150	7.2	227
1929	8	575	4,600	6.7	308
1930	8	415	3,320	6.4	212
1931	10	575	5,750	4.2	242
1932	14	400	5,600	3.8	213
1933	12	600	7,200	4.4	317
1934	12	410	4,920	4.7	231
1935	12	360	4,320	4.9	212
1936	11	380	4,180	5.2	217
1937	10	400	4,000	5.1	204
1938	11	420	4,620	4.9	226
1939	11	375	4,125	5.3	219
1940	11	360	3,960	5.0	198
1941	8	300	2,400	5.7	137
1942	24	325	7,800	5.1	398
1943	20	340	6,800	7.3	496
1944	5	275	1,375	8.4	116
1945	5	385	1,925	9.0	173
1946	4	280	1,120	10.8	121
1947	5	300	1,500	12.9	194
1948	3	335	1,005	14.0	141
1949	3	360	1,080	13.4	145

Table 51. - Irish potatoes (all): Acreage, yield, production, price, and value, 1909-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1909	20	65	1,300	1.02	1,326
1910	25	52	1,300	.78	1,014
1911	22	66	1,452	.85	1,234
1912	20	57	1,140	1.10	1,254
1913	21	58	1,218	.98	1,194
1914	20	61	1,220	.97	1,183
1915	22	49	1,078	1.05	1,132
1916	20	67	1,340	1.14	1,528
1917	23	68	1,564	2.59	4,051
1918	34	82	2,788	1.02	2,844
1919	20	53	1,060	1.81	1,919
1920	22	55	1,210	2.19	2,650
1921	23	63	1,449	1.63	2,362
1922	24	58	1,392	1.35	1,879
1923	23	64	1,472	1.45	2,134
1924	24	63	1,512	1.26	1,905
1925	29	57	1,653	1.33	2,198
1926	33	57	1,881	2.00	3,762
1927	36	53	1,908	1.69	3,225
1928	38	65	2,470	1.00	2,470
1929	29	56	1,624	1.50	2,436
1930	34	60	2,040	1.35	2,754
1931	48	75	3,600	.50	1,800
1932	40	51	2,040	.69	1,408
1933	38	54	2,052	.73	1,498
1934	42	60	2,520	.51	1,285
1935	39	65	2,535	.70	1,774
1936	39	68	2,652	1.25	3,315
1937	44	62	2,728	.65	1,773
1938	43	64	2,752	.60	1,651
1939	40	56	2,240	.75	1,680
1940	40	57	2,280	.81	1,847
1941	43	61	2,623	.61	1,600
1942	42	60	2,520	1.11	2,797
1943	57	62	3,534	1.57	5,548
1944	59	57	3,363	1.22	4,103
1945	42	61	2,562	1.93	4,945
1946	40	57	2,280	1.37	3,124
1947	31	53	1,643	1.60	2,629
1948	24	59	1,416	1.91	2,705
1949	21	59	1,239	1.91	2,366

Table 52. - Sweet potatoes: Acreage, yield, production, price, and value, 1909-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Farm value
	1,000 acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1909	57	75	4,275	.67	2,864
1910	55	78	4,290	.69	2,960
1911	57	81	4,617	.72	3,324
1912	56	78	4,368	.75	3,276
1913	60	80	4,800	.71	3,408
1914	58	79	4,582	.67	3,070
1915	62	78	4,836	.58	2,805
1916	64	79	5,056	.73	3,691
1917	62	78	4,836	1.12	5,416
1918	64	70	4,480	1.47	6,586
1919	68	80	5,440	1.62	8,813
1920	72	90	6,480	1.16	7,517
1921	73	80	5,840	.84	4,906
1922	64	85	5,440	.89	4,842
1923	54	80	4,320	1.24	5,357
1924	50	45	2,250	1.71	3,848
1925	60	70	4,200	1.62	6,804
1926	66	78	5,148	1.06	5,457
1927	83	82	6,806	.99	6,738
1928	62	77	4,774	1.01	4,822
1929	67	74	4,958	1.16	5,751
1930	60	68	4,080	1.11	4,529
1931	83	73	6,059	.60	3,635
1932	111	66	7,326	.46	3,370
1933	98	67	6,566	.65	4,268
1934	117	66	7,722	.74	5,714
1935	123	74	9,102	.58	5,279
1936	111	70	7,770	.87	6,760
1937	97	76	7,372	.69	5,087
1938	109	72	7,848	.64	5,023
1939	95	76	7,220	.63	4,549
1940	86	58	4,988	.76	3,791
1941	90	85	7,650	.72	5,508
1942	88	90	7,920	1.00	7,920
1943	124	80	9,920	1.81	7,955
1944	100	98	9,800	1.45	14,210
1945	116	105	12,180	1.46	17,783
1946	120	90	10,800	1.57	16,956
1947	90	87	7,830	1.52	11,902
1948	80	98	7,840	1.60	12,544
1949	85	98	8,330	1.70	14,161

Table 53. - Tobacco (perique): Acreage, yield, production, price, and value, 1919-49

Year	Acreage harvested	Yield per acre	Production	Season average price per pound	Farm value
	Acres	Pounds	1,000 pounds	Cents	1,000 dollars
1919	800	435	348	65.0	226
1920	800	475	380	40.0	152
1921	900	465	418	55.0	230
1922	1,100	435	478	55.0	263
1923	900	440	396	50.0	198
1924	800	400	320	55.0	176
1925	800	450	360	55.0	198
1926	100	400	40	45.0	18
1927	100	420	42	45.0	19
1928	200	405	81	45.0	36
1929	300	400	120	40.0	48
1930	600	445	267	30.0	80
1931	600	410	246	26.0	64
1932	400	430	172	27.5	47
1933	300	425	128	23.0	29
1934	100	350	35	20.0	7
1935	100	420	42	18.0	8
1936	100	480	48	25.0	12
1937	400	500	200	30.0	60
1938	600	500	300	30.0	90
1939	1,000	370	370	27.0	100
1940	500	275	138	25.0	34
1941	200	285	57	17.0	10
1942	200	350	70	30.0	21
1943	300	500	150	40.0	60
1944	400	525	210	42.5	89
1945	300	640	192	65.0	125
1946	300	500	150	80.0	120
1947	600	415	249	60.0	149
1948	300	800	240	60.0	144
1949	300	667	200		

Table 54. - Strawberries 1/: Acreage, yield, production, price, and value, 1918-49

Year	Acreage	Yield per acre	Production	Season average price per 24 pint crate	Total value
	Acres	24 pint crates	1,000 crates	Dollars	1,000 dollars
1918	4,900	124	608	2.875	1,748
1919	3,900	174	678	3.125	2,119
1920	6,500	140	910	3.35	3,048
1921	8,250	170	1,402	3.25	4,556
1922	11,560	152	1,758	2.15	3,780
1923	14,350	108	1,550	3.00	4,650
1924	14,600	102	1,490	3.25	4,842
1925	10,340	84	868	3.00	2,604
1926	18,500	112	2,072	3.34	6,920
1927	21,100	66	1,392	2.61	3,633
1928	23,200	116	2,692	3.01	8,103
1929	24,000	104	2,496	2.21	5,516
1930	22,000	88	1,936	2.56	4,956
1931	20,500	180	3,690	2.06	7,601
1932	23,000	134	3,082	1.21	3,729
1933	18,800	136	2,556	1.305	3,336
1934	19,400	128	2,484	1.385	3,440
1935	18,800	82	1,542	1.685	2,598
1936	14,800	168	2,486	1.74	4,326
1937	17,600	164	2,886	1.53	4,416
1938	22,000	100	2,200 2/	1.75	3,504
1939	20,000	140	2,800 2/	1.625	4,459
1940	23,000	90	2,070 2/	1.81	3,671
1941	23,000	140	3,220 2/	1,425	3,497
1942	21,000	144	3,024	2.05	6,199
1943	15,000	80	1,200	3.625	4,350
1944	11,000	90	990	4.925	4,876
1945	12,700	120	1,524	5.05	7,696
1946	16,800	128	2,150	5.20	11,180
1947	21,000	80	1,680	4.50	7,560
1948	19,000	86	1,634	5.135	8,391
1949	21,000	54	1,134	5.27	5,976

1/ Includes strawberries for processing.

2/ Includes some quantities not marketed and excluded in computing value: 198,000 crates in 1938; 56,000 crates in 1939; 42,000 crates in 1940; and 766,000 crates in 1941.

Table 55. - Oranges: Production, disposition, price, and value, 1919-49

Year	Production	Farm disposition		Season average price per box	Value of	
		Home consumption	Sold		Production	Sales
	1,000 boxes	1,000 boxes	1,000 boxes	Dollars	1,000 dollars	1,000 dollars
1919	37	12	25	2.79	103	70
1920	42	13	29	1.74	73	50
1921	50	13	37	2.39	120	88
1922	60	14	46	2.29	137	105
1923	75	14	61	.84	63	51
1924	75	15	60	1.72	129	103
1925	100	16	84	2.23	223	187
1926	150	17	133	2.11	316	281
1927	200	19	181	3.51	702	635
1928	220	20	200	2.50	550	500
1929	187	18	169	2.86	535	483
1930	287	22	265	1.53	439	405
1931	245	22	223	1.33	326	297
1932	278	22	256	1.28	356	328
1933	245	24	221	1.44	353	318
1934	293	24	269	1.06	311	285
1935	244	25	219	1.62	395	355
1936	309	25	284	1.62	501	460
1937	238	25	213	1.37	326	292
1938	385	30	355	1.00	385	355
1939	228	22	206	1.10	251	227
1940	253	20	233	1.00	253	233
1941	192	13	179	1.20	230	215
1942	340	16	324	2.25	765	729
1943	240	14	226	3.40	816	768
1944	360	14	346	2.60	936	900
1945	330	14	316	2.55	842	806
1946	410	16	394	1.90	779	749
1947	300	16	284	1.75	525	497
1948	300	16	284	1.85	555	525
1949	310	16	294	1.75	542	514

Table 56. - Peaches: Production, price, and value, 1909-49

Year	Production	Season average price	Farm value
	1,000 bushels	Dollars per bushel	1,000 dollars
1909	291	.78	227
1910	488	1.00	488
1911	190	1.00	190
1912	680	.80	544
1913	437	1.50	656
1914	320	1.00	320
1915	385	.95	366
1916	441	.85	375
1917	363	1.25	454
1918	416	1.40	582
1919	382	1.80	688
1920	267	2.70	721
1921	237	1.45	344
1922	160	1.45	232
1923	116	1.90	220
1924	204	1.85	377
1925	239	1.75	418
1926	211	1.50	316
1927	86	1.80	155
1928	224	1.60	358
1929	195	1.70	332
1930	160	1.75	280
1931	392	1.05	412
1932	122	1.05	128
1933	239	1.10	263
1934	318	.75	238
1935	280	1.05	294
1936	347	1.10	382
1937	232	1.25	290
1938	271	1.00	271
1939	327	1.05	343
1940	358	1.00	358
1941	334	1.05	351
1942	319	1.30	415
1943	176	3.10	546
1944	296	3.00	888
1945	320	2.95	944
1946	293	3.05	894
1947	270	2.85	770
1948	330	2.90	957
1949	265	2.80	742

Table 57. - Pears: Production, price, and value, 1909-49

Year	Production	Season average price	Farm value
	1,000 bushels	Dollars per bushel	1,000 dollars
1909	36		
1910	31		
1911	24		
1912	52		
1913	47		
1914	52		
1915	55		
1916	52		
1917	49		
1918	58		
1919	59	1.25	74
1920	48	1.75	84
1921	46	2.29	105
1922	62	1.71	106
1923	42	1.70	71
1924	60	1.90	114
1925	69	1.45	100
1926	68	1.30	88
1927	52	1.40	73
1928	73	1.35	99
1929	70	1.35	94
1930	81	1.30	105
1931	127	.90	114
1932	92	.70	64
1933	69	1.00	69
1934	160	.55	88
1935	113	.75	85
1936	194	.65	126
1937	74	.70	52
1938	207	.50	104
1939	144	.70	101
1940	248	.50	124
1941	171	.60	103
1942	239	.65	155
1943	78	1.70	133
1944	245	1.25	306
1945	228	1.30	296
1946	235	1.50	352
1947	207	1.45	300
1948	240	1.25	300
1949	198	1.30	257

Table 58. - Pecans (improved and seedling): Production, price, and value, 1919-49

Year	Production			Season average price *		Total farm value (all varieties)
	Improved varieties	Wild or seedling varieties	Total	Improved varieties	Wild or seedling varieties	
	1,000 pounds	1,000 pounds	1,000 pounds	Cents per pound	Cents per pound	1,000 dollars
1919	750	4,250	5,000	-	-	1,450
1920	100	600	700	-	-	217
1921	920	4,680	5,600	-	-	1,176
1922	100	500	600	40.0	18.0	130
1923	720	3,530	4,250	37.0	15.0	796
1924	310	1,440	1,750	42.0	23.0	461
1925	1,020	4,510	5,530	32.0	17.0	1,093
1926	1,110	4,890	6,000	32.0	14.0	1,040
1927	440	1,810	2,250	38.0	16.0	457
1928	1,070	4,430	5,500	27.0	10.7	763
1929	532	2,128	2,660	31.0	15.0	484
1930	1,595	6,378	7,973	24.0	12.0	1,148
1931	1,802	6,390	8,192	16.0	7.5	767
1932	1,356	4,808	6,164	13.0	7.0	513
1933	2,326	8,249	10,575	10.5	6.0	739
1934	960	3,212	4,172	17.0	11.0	516
1935	1,934	6,858	8,792	13.8	7.3	768
1936	1,722	5,454	7,176	16.3	10.9	875
1937	3,326	7,762	11,088	12.0	6.5	904
1938	2,140	4,548	6,688	13.0	7.8	633
1939	2,153	5,023	7,176	13.9	7.7	686
1940	3,074	5,710	8,784	13.2	7.8	851
1941	1,400	4,200	5,600	15.6	8.2	562
1942	1,900	4,500	6,400	19.8	13.5	984
1943	2,640	9,360	12,000	26.0	18.5	2,418
1944	3,744	10,656	14,400	25.7	16.2	2,688
1945	1,840	7,360	9,200	26.2	20.0	1,954
1946	2,250	6,750	9,000	35.1	29.4	2,774
1947	1,400	3,000	4,400	35.5	21.0	1,127
1948	4,700	14,300	19,000	18.0	10.5	2,348
1949	2,040	11,600	13,640	21.0	15.0	2,168

* December 1 price prior to 1937.

Table 59. - Snap beans (mid-spring market): Acreage, yield, production, price, and value, 1918-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 Bushels	Dollars	1,000 Dollars
1918	1,400	95	133	2.25	299
1919	1,500	85	128	2.35	301
1920	1,300	65	84	2.25	189
1921	2,000	80	160	2.75	440
1922	1,460	78	114	1.60	182
1923	1,540	70	108	2.55	275
1924	3,200	88	282	1.80	508
1925	5,000	74	370	1.35	500
1926	5,500	56	308	2.15	662
1927	6,200	55	341	1.35	460
1928	7,400	55	407	1.55	631
1929	8,000	80	640	1.35	864
1930	8,400	66	554	1.05	582
1931	8,000	76	608	.81	492
1932	7,600	65	494 1/	.55	243
1933	4,500	65	292	.82	239
1934	8,000	70	560 1/	.72	333
1935	8,800	68	598	.71	425
1936	8,800	64	563	1.20	676
1937	9,200	55	506	1.15	582
1938	10,900	60	654	.70	458
1939	9,200	55	506	.90	455
1940	7,300	55	402 1/	1.15	345
1941	6,600	65	429	1.25	536
1942	7,400	70	518	1.40	725
1943	8,200	53	435	2.30	1,000
1944	6,000	75	450	2.25	1,012
1945	6,000	90	540	2.50	1,350
1946	7,200	53	382	2.10	802
1947	5,400	52	281	2.30	646
1948	4,800	70	336	2.75	924
1949	4,400	70	308	2.75	847

1/ Includes some quantities not marketed and excluded in computing value: 52,000 bushels in 1932; 98,000 bushels in 1934; 102,000 bushels in 1940.

Table 60. - Snap beans (early fall market): Acreage, yield, production, price, and value, 1922-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1922	300	70	21	1.75	37
1923	700	80	56	1.85	104
1924	900	75	68	1.85	126
1925	3,200	49	157	1.85	290
1926	3,300	65	214	1.65	353
1927	3,600	54	194	1.30	252
1928	3,200	73	234	1.55	363
1929	4,000	75	300	1.10	330
1930	3,600	42	151	1.03	156
1931	2,600	65	169	.95	161
1932	2,600	55	143	.60	86
1933	3,700	50	185	.68	126
1934	4,900	55	270	.80	216
1935	5,600	48	269	1.00	269
1936	6,200	44	273	.90	246
1937	4,400	50	220	1.35	297
1938	3,700	75	278	.80	222
1939	4,000	65	260	.95	247
1940	4,400	80	352	.65	229
1941	3,000	40	120	1.65	198
1942	2,400	55	132	1.90	251
1943	2,100	67	141	2.40	338
1944	2,200	75	165	2.45	404
1945	3,000	85	255	2.75	701
1946	2,900	90	261	2.40	626
1947	2,400	50	120	2.40	288
1948	2,300	70	161	2.30	370
1949	2,400	70	168	1.70	221

Table 61. - Cabbage (market): Acreage, yield, production, price, and value, 1918-49

Year	Acreage harvested	Yield per acre	Production	Season average price per ton	Total value
	Acres	Tons	Tons	Dollars	1,000 dollars
1918	1,400	4.0	5,600	55.00	308
1919	1,540	4.0	6,200	52.50	326
1920	1,480	7.0	10,400	40.20	418
1921	1,580	6.4	10,100	22.50	227
1922	1,670	6.0	10,000	20.00	200
1923	2,000	5.5	11,000	42.70	470
1924	1,800	3.5	6,300	48.80	307
1925	2,500	6.0	15,000	22.50	338
1926	3,000	4.5	13,500	35.20	475
1927	3,200	4.8	15,400	21.80	336
1928	3,500	4.5	15,800	23.10	365
1929	3,100	4.7	14,600	22.10	323
1930	2,100	3.3	6,900	35.80	247
1931	5,400	3.3	17,800	16.60	295
1932	3,200	4.0	12,800	26.50	339
1933	2,200	4.8	10,600	21.60	229
1934	9,300	2.8	26,000	10.60	276
1935	1,800	4.6	8,300	23.00	191
1936	3,600	3.5	12,600	18.50	233
1937	4,200	3.3	13,900	23.00	320
1938	3,800	4.2	16,000 1/	14.60	210
1939	4,600	3.6	16,600 1/	20.50	299
1940	4,600	3.6	16,600 1/	24.00	350
1941	4,600	4.2	19,300	22.00	425
1942	5,700	4.3	24,500	16.50	404
1943	5,100	3.2	16,300	67.50	1,100
1944	7,700	4.3	33,100 1/	28.00	913
1945	7,500	4.5	33,800	26.00	879
1946	7,400	4.7	34,800	40.00	1,392
1947	8,000	4.5	36,000	19.80	713
1948	5,000	4.0	20,000	45.20	904
1949	5,300	4.2	22,300	29.00	647

1/ Includes some quantities not marketed and excluded in computing value: 1,600 tons in 1938; 2,000 in 1939; 2,000 in 1940; 500 in 1944.

Table 62. - Watermelons (market): Acreage, yield, production, price, and value, 1934-49

Year	Acreage harvested	Yield per acre	Production	Season average price per thousand	Total value
	Acres	Melons	1,000 melons	Dollars	1,000 dollars
1934	2,900	240	696	85	59
1935	3,100	290	899	90	81
1936	4,900	260	1,274	100	127
1937	4,800	350	1,680	96	161
1938	4,600	290	1,334	113	151
1939	5,000	250	1,250	143	179
1940	4,500	280	1,260	156	197
1941	3,600	270	972	169	164
1942	2,800	300	840	225	189
1943	2,700	300	810	435	352
1944	4,000	280	1,120	500	560
1945	3,800	250	950	520	494
1946	4,100	230	943	420	396
1947	3,100	280	868	356	309
1948	2,500	250	625	450	281
1949	2,300	280	644	407	262

Table 63. - Beets (market): Acreage, yield, production, price, and value, 1927-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1927	3,000	60	180	.50	90
1928	2,700	172	464	.56	260
1929	2,500	170	425	.48	204
1930	2,300	130	299	.64	191
1931	2,200	117	257	.36	93
1932	2,100	115	242	.45	109
1933	2,100	104	218	.38	83
1934	2,200	135	297	.30	89
1935	2,000	135	270	.48	130
1936	1,500	125	188	.40	75
1937	1,500	145	218	.55	120
1938	1,100	140	154	.40	62
1939	1,100	145	160	.45	72
1940	1,000	130	130	.50	65
1941	900	135	122	.50	61
1942	800	100	80	.75	60
1943	700	110	77	1.15	89
1944	700	90	63	1.15	72
1945	500	100	50	1.15	58
1946	500	110	55	1.15	63
1947	500	96	48	1.00	48
1948	400	90	36	1.30	47
1949	300	95	28	1.45	41

Table 64. - Cucumbers: Acreage, yield, production, price, and value, 1923-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
			Early fall (market)		
1928	800	88	70	1.40	98
1929	780	83	65	1.25	81
1930	800	75	60	.98	59
1931	850	83	71	.89	63
1932	950	80	76	.92	70
1933	900	82	74	.90	67
1934	650	77	50	1.00	50
1935	850	75	64	.90	58
1936	750	90	68	.65	44
1937	800	65	52	1.35	70
1938	900	90	81	.90	73
1939	1,200	115	138	.68	94
1940	900	80	72	1.05	76
1941	900	72	65	1.15	75
1942	750	85	64	2.85	182
1943	1,050	100	105	3.20	336
1944	1,500	84	126	1.35	170
1945	1,000	100	100	3.50	350
1946	1,200	120	144	2.00	288
1947	900	60	54	3.35	181
1948	900	65	58	2.30	133
1949	800	90	72*	1.70	99
			Late spring (market)		
1923	250	85	21	1.80	38
1924	450	100	45	1.75	79
1925	500	70	35	1.95	68
1926	700	80	56	1.60	90
1927	650	85	55	1.20	66
1928	900	85	76	1.25	95
1929	660	90	59	1.31	77
1930	800	98	78	1.06	83
1931	400	120	48	.94	45
1932	450	100	45	.60	27
1933	450	75	34	.58	20
1934	480	75	36	.50	18
1935	600	90	54	.70	38
1936	500	85	42	1.00	42
1937	550	80	44	.85	37
1938	500	80	40	.55	22
1939	500	90	45	.85	38
1940	550	80	44	1.00	44
1941	600	96	58	.82	48
1942	600	95	57	1.00	57
1943	480	90	43	2.30	99
1944	1,000	100	100	2.10	210
1945	850	95	81	2.30	186
1946	1,000	100	100	1.65	165
1947	800	60	48	1.65	79
1948	750	100	75	2.50	188
1949	650	80	52	1.95	101

* Includes 14,000 bushels not marketed and excluded in computing value.

Table 65. - Tomatoes (market): Acreage, yield, production, price, and value, 1925-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1925	1,020	100	102	3.00	306
1926	1,690	76	128	1.80	230
1927	1,680	90	151	1.00	151
1928	1,200	98	118	1.25	148
1929	1,100	89	98	1.25	122
1930	1,200	100	120	1.10	132
1931	1,300	98	127	1.25	159
1932	1,600	89	142	1.45	206
1933	2,100	94	197	.90	177
1934	2,200	100	220	.70	154
1935	2,700	71	192	.75	144
1936	2,800	75	210	1.00	210
1937	2,800	70	196	1.25	245
1938	3,100	77	239	.60	143
1939	3,000	72	216	1.15	248
1940	3,300	80	264	.80	211
1941	3,300	78	257 1/	1.15	258
1942	3,100	72	223 1/	1.80	360
1943	2,900	55	160	3.50	560
1944	2,600	50	130	3.25	422
1945	2,500	72	180	3.35	603
1946	2,100	62	130	3.50	455
1947	1,800	60	108	2.55	275
1948	1,600	75	120	3.50	420
1949	1,800	70	126	2.55	321

1/ Includes quantities not marketed and excluded in computing value: 33,000 bushels in 1941; 23,000 bushels in 1942.

Table 66. - Onions (market): Acreage, yield, production, price, and value, 1918-49

Year	Acreage	Yield per acre	Production	Season average price per 50 lb. sack	Total value
	Acres	50 lb. sacks	1,000 50 lb. sacks	Dollars	1,000 dollars
1918	1,560	190	296	1.60	474
1919	970	160	155	2.85	442
1920	1,080	158	171	1.86	318
1921	1,010	206	208	.95	198
1922	1,100	300	330	1.51	498
1923	1,200	90	108	1.79	193
1924	1,670	124	207	.89	184
1925	2,320	120	278	1.36	378
1926	2,750	128	352	1.17	412
1927	2,900	108	313	1.22	382
1928	2,300	130	299	.88	263
1929	2,200	130	286	1.08	309
1930	1,260	60	76	1.15	87
1931	1,100	90	99	1.00	99
1932	1,200	80	96	.80	77
1933	500	70	35	.88	31
1934	1,600	84	134	.50	67
1935	1,200	82	98	.83	81
1936	1,100	108	119	.88	105
1937	1,700	108	184	.65	120
1938	1,700	100	170	.72	122
1939	1,600	112	179	.70	125
1940	1,400	82	115	1.30	150
1941	1,700	100	170	1.08	184
1942	1,900	110	209	.88	184
1943	1,800	90	162	1.65	267
1944	1,800	100	180	2.60	468
1945	2,000	110	220	2.10	462
1946	2,000	95	190	2.20	418
1947	1,550	80	124	1.70	211
1948	1,250	90	112	2.60	291
1949	1,300	100	130	2.00	260

Table 67. - Garlic (market): Acreage, yield, production, price, and value, 1932-49

Year	Acreage harvested	Yield per acre	Production	Season average price per 100 lb. sack	Total value
	Acres	100 lb. sacks	1,000 100 lb. sacks	Dollars	1,000 dollars
1932	500	14.0	7	2.50	18
1933	500	12.0	6	5.50	33
1934	500	14.0	7	3.50	24
1935	700	13.3	9	2.50	22
1936	500	13.8	7	4.50	32
1937	600	13.9	8	4.50	36
1938	750	14.2	11	4.50	50
1939	700	13.8	10	3.75	38
1940	700	13.6	10	4.00	40
1941	770	13.8	11	6.00	66
1942	1,200	14.0	17	4.00	68
1943	1,100	13.6	15	5.00	75
1944	1,000	13.0	13	8.00	104
1945	900	13.0	12	15.50	186
1946	900	12.5	11	20.00	220
1947	900	13.5	12	13.50	162
1948	800	12.5	10	10.50	105
1949	750	12.5	9	9.80	88

Table 68. - Shallots (market): Acreage, yield, production, price, and value, 1937-49

Year	Acreage	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
			Spring (market)		
1937	2,800	124	347	.67	232
1938	2,700	95	256	.98	251
1939	2,400	136	326 1/	.45	125
1940	2,000	136	272	.60	163
1941	1,900	140	266	.95	253
1942	2,400	130	312	.80	250
1943	2,300	85	196	1.80	353
1944	2,100	80	168	2.50	420
1945	2,200	105	231	1.35	312
1946	2,200	100	220	1.90	418
1947	2,000	100	200	1.80	360
1948	1,900	100	190	1.55	294
1949	1,600	60	96	2.10	202
			Winter (market)		
1937	3,200	117	374	.75	280
1938	3,000	78	234	1.15	269
1939	3,000	116	348	.55	191
1940	2,700	120	324	.70	227
1941	2,200	104	229	.90	206
1942	2,800	132	370	.85	314
1943	2,700	94	254	1.25	318
1944	1,900	90	171	2.25	385
1945	2,700	140	378	1.85	699
1946	3,200	140	448	1.90	851
1947	2,700	90	243	2.15	522
1948	2,900	110	319	1.70	542
1949	2,900	100	290	1.65	478

1/ Includes 48,000 bushels not marketed and excluded in computing value.

Table 69. - Eggplant (market): Acreage, yield, production, price, and value, 1925-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1925	400	190	76	1.05	80
1926	540	130	70	1.05	74
1927	450	156	70	1.00	70
1928	680	159	108	.90	97
1929	650	154	100	1.30	130
1930	600	147	88	.87	77
1931	500	144	72	1.50	108
1932	500	158	79	1.00	79
1933	500	146	73	.75	55
1934	550	150	82	.50	41
1935	650	156	101	.75	76
1936	550	100	55	.60	33
1937	500	138	69	.65	45
1938	750	150	112	.45	50
1939	700	125	88	.70	62
1940	600	140	84	.85	71
1941	550	140	77	.90	69
1942	500	145	72	1.20	86
1943	500	170	85	1.50	128
1944	450	155	70	1.35	94
1945	400	150	60	1.95	117
1946	400	135	54	1.60	86
1947	350	145	51	1.45	74
1948	350	150	52	1.35	70
1949	300	150	45	1.60	72

Table 70. -Green peppers (market): Acreage, yield, production, price, and value, 1924-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1924	850	175	149	1.30	194
1925	1,700	160	272	1.20	326
1926	2,000	150	300	1.40	420
1927	1,600	180	288	1.20	346
1928	2,100	140	294	.90	265
1929	1,300	200	260	.93	242
1930	1,150	150	172	.70	120
1931	1,100	220	242	.65	157
1932	900	130	117	.85	99
1933	1,050	210	220	.60	132
1934	1,050	145	152	.48	73
1935	1,250	223	279	.49	137
1936	1,300	150	195	.48	94
1937	1,200	200	240	.60	144
1938	1,600	220	352	.50	176
1939	1,400	140	196	1.10	216
1940	1,150	140	161	.80	129
1941	1,300	200	260	.60	156
1942	1,100	148	163	1.15	187
1943	1,100	220	242	3.25	786
1944	1,400	200	280	1.90	532
1945	1,300	215	280	2.20	616
1946	1,650	121	200	2.20	440
1947	1,650	170	280 1/	2.80	630
1948	1,850	190	352	1.80	634
1949	1,850	185	342 1/	2.60	757

1/ Includes 55,000 bushels not marketed and excluded in computing value in 1947, and 51,000 bushels in 1949.

Table 71. - Carrots (market): Acreage, yield, production, price, and value, 1923-49

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1923	1,220	270	329	.78	257
1924	1,270	235	298	1.03	307
1925	2,360	243	573	.70	401
1926	3,750	172	645	.70	452
1927	4,750	211	1,002	.51	511
1928	2,500	171	428	.51	218
1929	2,300	169	389	.62	241
1930	2,300	125	288	.50	144
1931	2,200	105	231	.31	72
1932	2,200	100	220	.40	88
1933	2,100	90	189	.37	70
1934	2,100	120	252	.32	81
1935	1,900	123	234	.60	140
1936	1,900	120	228	.40	91
1937	1,900	138	262	.60	157
1938	2,200	130	286	.40	114
1939	2,200	147	323	.45	145
1940	2,000	120	240	.55	132
1941	2,000	125	250	.55	138
1942	1,800	125	225	.80	180
1943	1,700	110	187	1.05	196
1944	1,500	105	158	1.15	182
1945	1,500	110	165	1.30	214
1946	1,350	110	148	1.50	222
1947	1,250	105	131	1.45	190
1948	1,150	105	121	1.70	206
1949	1,100	105	116	1.40	162

Table 72.- Spinach (market): Acreage, yield, production, price, and value, 1925-49.

Year	Acreage harvested	Yield per acre	Production	Season average price per bushel	Total value
	Acres	Bushels	1,000 bushels	Dollars	1,000 dollars
1925	1,900	105	200	.40	80
1926	1,700	100	170	.50	85
1927	1,650	110	182	.45	82
1928	2,100	107	225	.48	108
1929	2,000	100	200	.48	96
1930	1,990	50	100	.50	50
1931	1,500	70	105	.40	42
1932	1,200	85	102	.40	41
1933	1,200	105	126	.30	38
1934	1,500	95	142	.29	41
1935	1,200	85	102	.45	46
1936	1,100	102	112	.35	39
1937	1,100	100	110	.60	66
1938	1,200	115	138	.50	69
1939	1,350	110	148	.48	71
1940	1,350	87	117	.55	64
1941	1,250	96	120	.60	72
1942	1,150	87	100	.75	75
1943	1,000	75	75	1.15	86
1944	1,000	70	70	1.05	74
1945	900	75	68	1.15	78
1946	900	70	63	1.20	76
1947	800	65	52	1.35	70
1948	700	70	49	1.45	71
1949	650	70	46	1.50	69

TECHNOLOGY AND SCIENCE ROOM

Table 73.- Commercial truck crops for processing: Acreage, production, and value, 1928-49.

Year	Acreage harvested	Production	Total value
	Acres	Tons	1,000 dollars
1928	3,640	2,100	129
1929	3,640	4,020	185
1930	5,840	6,230	202
1931	2,620	2,610	84
1932	1,630	1,840	42
1933	1,110	1,700	32
1934	1,680	1,530	33
1935	2,230	3,130	52
1936	2,680	2,130	45
1937	3,680	5,850	127
1938	3,300	4,510	101
1939	2,000	2,500	66
1940	3,550	5,100	122
1941	4,950	5,400	145
1942	5,200	7,800	293
1943	5,800	6,000	393
1944	4,800	4,500	276
1945	4,650	5,800	324
1946	4,420	3,980	280
1947	3,440	3,760	275
1948	2,330	1,860	127
1949	2,380	2,430	168

93b
2d set

LOUISIANA BULLETIN NO. 445 **JUNE, 1950**

FORM CLASS VOLUME TABLES
for Use in
SOUTHERN PINE PULPWOOD
TIMBER ESTIMATING

BY
CHARLES O. MINOR

TECHNOLOGY AND SCIENCE ROOM

UNIVERSITY OF MARYLAND
MAR 27 1961

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, DIRECTOR

INDEX TO PULPWOOD VOLUME TABLES

Unit of Volume	Height Classification	Form Class		Table Number	Page Number
		Class	Range		
Cubic Feet	Total Height	67	65-69	1A	10
		72	70-74	2A	12
		77	75-79	3A	14
		82	80-84	4A	16
		87	85-89	5A	18
	Merchantable Height	67	65-69	1B	11
		72	70-74	2B	13
		77	75-79	3B	15
		82	80-84	4B	17
		87	85-89	5B	19
Rough Cords	Total Height	67	65-69	6A	20
		72	70-74	7A	22
		77	75-79	8A	24
		82	80-84	9A	26
		87	85-89	10A	28
	Merchantable Height	67	65-69	6B	21
		72	70-74	7B	23
		77	75-79	8B	25
		82	80-84	9B	27
		87	85-89	10B	29
Cords per Tree	Total Height	67	65-69	11A	30
		72	70-74	12A	32
		77	75-79	13A	34
		82	80-84	14A	36
		87	85-89	15A	38
	Merchantable Height	67	65-69	11B	31
		72	70-74	12B	33
		77	75-79	13B	35
		82	80-84	14B	37
		87	85-89	15B	39

Form Class Volume Tables for Use in Southern Pine Pulpwood Timber Estimating

BY CHARLES O. MINOR

Introduction

The volume tables included in this publication have been developed for use in estimating pulpwood contents of southern pine trees and stands. The tables were constructed to fill a need for pulpwood volume tables which would incorporate the principle of "Form Class" in computing tree volumes. In too many cases existing pine pulpwood volume tables do not take into account the effect upon tree volume of differences in degree of taper in trees of the same diameter and height. When the effect of taper is considered in present-day volume tables it is usually through types of taper or form recognition other than the simple, easily applied form class method. The development by Girard and Mesavage (1)[1] of form class volume tables for sawlog-size timber and the subsequent adoption of their tables on almost a nation-wide basis, has, it is believed, brought about a need for pulpwood volume tables which would also use the form class principle in separating tree taper variations.

Work on the present tables was first begun in 1947 owing to dissatisfaction on the part of the writer, and others, with existing pulpwood tables. Especially poor results were obtained when the available tables were demonstrated to students during field practice in pulpwood timber estimating. In such cases where only relative degrees of accuracy were expected or desired, it was obvious to even the most inexperienced students that some degree of recognition of differing tree tapers or form would be desirable. This was especially apparent in view of the simple application of form class to saw-log timber cruising and the resultant accuracy gained. Also during the period of adoption of the Girard and Mesavage sawlog volume tables (1) several industrial foresters made specific inquiries of the writer as to the possibility of developing form class volume tables for pulpwood. In view of the above, and because of a belief that pulpwood volume tables should show an improvement in accuracy commensurate with the increased present-day demand for pulpwood, the volume tables presented herein were constructed.

---

[1] Numbers in parentheses refer to literature cited as listed in the bibliography.

Use of the Volume Tables

These tables are designed for use in determining volumes of southern pine trees of normal pulpwood size. Utilization of the trees is assumed to be average present-day standards as regards minimum and maximum diameters breast high and minimum merchantable top diameters. If information is desired regarding cubic contents of the merchantable portions of sawlog-size trees the reader is referred to the recent volume tables published by the Southern Forest Experiment Station (2).

Volumes are presented in a number of forms in the following tables to make their application as simple and usable as is feasible. The tables (A) on the left hand pages are based upon total tree height, to the nearest 10 feet; the tables (B) on right hand pages are based upon merchantable length of the stem, by 5-foot intervals. Furthermore, in both A and B tables the tree volumes are expressed in three separate ways:

(a) Merchantable cubic foot volume (inside bark) per tree.

(b) Standard stacked cords (128 cubic feet) of rough (unpeeled) pulpwood per tree. Hereafter these will be referred to as rough cords.

(c) Trees per rough cord.

Use of the included tables requires the determination of form class in similar fashion as in sawlog cruising. Form class refers to the usual percentage ratio between inside bark diameter at the top of the first 16-foot log and the diameter outside bark at breast height, as was developed in the previously mentioned tables of Girard and Mesavage (1). In sawlog timber cruising, form class is commonly measured or estimated ocularly to the nearest one or two percent; however, since these volume tables are designed for application to pulpwood size trees where slight variations in form may be difficult to determine, the tables have been constructed by form class groups. Each group covers a range of five form classes, or five percent, much as recommended by Mesavage (2). Therefore the tables require only the estimation of form class within one of these five-percent groups.

Tables designated A are based upon total tree height, diameter breast high (outside bark) and form class, and give the merchantable pulpwood contents per tree to a variable top diameter. This top diameter, as determined by bole size, branches, defect, or other limiting factor, averaged about 3 inches (inside bark) for all but the larger trees. No attempt was made to set a specific top size, but rather an average merchantable length per total height was established for each diameter class.

These total height tables are designed primarily for use in pulpwood cruising when only diameters are tallied on all trees on the sample plot or strip. By this method it is necessary only to measure a sufficient sample of total heights to establish a satisfactory curve of height over diameter. Then a "local volume table" is constructed by interpolating, from the proper form class group volume table, a volume for each diameter class, based upon diameter breast high and curved total height.

The advantage of tables based upon total height lies in the easier, more accurate measurement of total height, as compared with the rather difficult estimation or measurement of merchantable height in pulpwood-size trees. Total height is a more definite, fixed point of measurement, while merchantable height is extremely variable and choice of the point of top measurement will differ between various estimators. Because of these factors of ease and accuracy, and because total height volume tables readily lend themselves to application of the local volume table method of cruising with its reduction in necessary field work, it is felt that the volume tables based on total height should be applied in the majority of pulpwood estimates. The limiting factors regarding these total height tables are that the stands be second growth southern pine and that utilization standards be similar; i.e., minimum top diameter approximately 3 inches inside bark. These limitations occur because of the necessary merchantable height-total height ratios.

The volume tables designated B show the merchantable contents of pulpwood-size trees based upon merchantable stem length, diameter breast high (outside bark) and form class. Here again the top diameter is variable because the merchantable length is to the limit of pulpwood merchantability. The average top diameter, however, is about 3 inches inside bark. Heights are by 5-foot intervals for easier estimation or measurement. Also the present practice of cutting pulpwood bolts into lengths of 5 feet, or close proximity, would logically lead to conversion of the tables, by the user, into terms of number of bolts per tree in place of the present 5-foot heights.

These merchantable stem length tables may be applied in the normal manner as "standard" volume tables where the diameter and height of every tree is determined, or the "local volume table" procedure as described for the total height tables also may be applied, using merchantable length over diameter as the variable for curving.

With several reservations the writer ventures to suggest that these merchantable length volume tables might be applied to the so-called "pulping" hardwoods where pulpwood volumes are desired. However, differences in standards of utilization, particularly as regards minimum top diameter and utilization of branch wood, may invalidate use of the included tables.

Method of Table Construction

The writer makes no claim as to originality regarding the method of construction used in these volume tables. Procedures developed by others, particularly Mesavage (2), were drawn upon freely. The objective throughout was to develop a set of tables which would meet certain preconceived ideas as to volume presentation and methods of application, with no thought in mind of developing any new techniques of construction. The writer does make one claim and that is to having used, during early work on these tables, the technique of applying Huber's formula to the butt-log portion of the tree, prior to publication by Mesavage of tables in which the same technique appeared.

Field work in gathering data for table construction consisted of making individual tree analyses to establish certain curves, ratios, and other values which would be used in office computations. Various pine pulpwood cutting operations were visited throughout the Florida Parishes of Louisiana. As an individual tree was felled and bucked by the pulpwood cutters, measurements were made of the diameter inside and outside bark at the stump, at breast height, at 16 feet above the stump, and at the top of each bolt cut from the tree. The height of the stump was measured, as were the length of each pulpwood bolt and the length of the unused top. In addition other data were gathered regarding age and growth at various sections of the tree bole. Information of this nature was compiled on 300 pulpwood-size trees.

The field data were curved to yield information on taper in the top 8 feet of the first 16-foot log, merchantable lengths for various total heights, and the ratio of mid-diameter (inside bark) above 16 feet to diameter (inside bark) at 16 feet. With these relationships established the basic procedure outlined by Mesavage (2) was followed in computing cubic foot volumes. Briefly the procedure is as follows:

a. Tree diameter breast high multiplied by form class equals diameter (inside bark) at top of first 16-foot log.

b. Diameter (inside bark) at top of first 16-foot log plus taper of upper 8 feet of first 16-foot log equals mid-diameter (inside bark) of first log.

c. Basal area (square feet) corresponding to mid-diameter (inside bark) of first log multiplied by 16 feet equals cubic foot volume (inside bark) of first 16-foot log.

d. Diameter (inside bark) at top of first 16-foot log multiplied by percentage ratio equals mid-diameter (inside bark) of merchantable stem above 16 feet.

e. Basal area (square feet) corresponding to this upper mid-diameter (inside bark) multiplied by merchantable length (feet) above 16 feet equals cubic foot volume (inside bark) above first 16-foot log.

f. Volume of first 16-foot log plus volume of merchantable stem above 16 feet equals tree volume in cubic feet (inside bark).

The cubic foot volumes (inside bark) were converted to rough cords by applying conversion factors derived from a combination of the results of other investigators. These conversion factors consisted of a solid wood content (cubic feet) per stacked cord of rough wood for each diameter class. Relative solid content values between tree diameters as determined by Chaiken and MacKinney (3) were curved to agree with the average conversion factors of the Southern Forest Experiment Station (2) and compared with a study by Schumacher (4) and with a local study of the Forest Products Laboratory (5). Validity of the final derived values was then checked by a limited (12 cords) study using a dot grid on photographs as described by Mountain (6).

Rough cord volumes per tree were converted into terms of trees per rough cord by dividing the cord volume into unity; i.e., determination of the reciprocal of the rough cord volume.

Tests of Table Accuracy

The tables have been given only limited tests within the same local region from which the original field data were gathered. Because of this the tables are subject to any changes which may be indicated through results of their application. The writer would especially appreciate reports on use of the tables and would welcome any suggestions as to revisions which experience may indicate.

Results of comparing actual tree volumes with volume table volumes are presented in tabular form as follows:

Table 1: Actual Cubic Foot Volumes Compared with Volume Table Volumes

AREA	No. Trees	Act. Vol. (cu. ft.)	Vol. Table (cu. ft.)	DIFF. (percent)
South Livingston Parish (Loblolly and Spruce pine)	93	1754.8	1739.4	−0.88
North Livingston Parish (Loblolly pine)	93	811.0	813.1	+0.26
Washington Parish (Planted Slash pine)	55	331.3	313.2	−5.46
St. Helena Parish (Loblolly and Shortleaf pine)	13	168.9	173.5	+2.72
TOTAL:	254	3066.0	3039.2	−0.87

Table 2: Actual Rough Cord Volumes Compared with Volume Table Volumes

AREA	No. Trees	Act. Vol. (cords)	Vol. Table (cords)	DIFF. (percent)
South Livingston Parish (Loblolly & Spruce pine)	93	22.16	21.99	–0.77
North Livingston Parish (Loblolly pine)	93	10.71	10.58	–1.21
Washington Parish (Planted Slash pine)	55	4.47	4.14	–7.38
St. Helena Parish (Loblolly and Shortleaf pine)	13	2.20	2.25	+2.27
TOTAL:	254	39.54	38.96	–1.47

Two brief checks on rough cord volumes were made on a mechanized pulpwood operation in Livingston Parish. Diameter breast high, total height, and form class were determined on standing trees. As the trees were felled they were numbered and followed through the mechanical bucking operation to the point of loading in pulpwood pallets. The occupied area, in cords, of each pallet was measured and computed and compared with the volume table volumes. Results of the tests were as follows:

Test 1: Consisted of 36 trees which when cut occupied 14 pallets. The pallet volume in cords was computed as 11.77 cords; the volume table volumes for the 36 trees totalled 11.72 rough cords. Difference was 0.05 cords or 0.5 percent.

Test 2: On a different area 86 trees and 20 pallets were analyzed. Pallet volume was computed as 16.60 cords, while volume table volume for the 86 trees was 16.87 rough cords. Difference was 0.27 cords or 1.6 percent.

One large pulp company in Louisiana has already used the tables in temporary form and has expressed satisfaction with the results obtained through their application.

BIBLIOGRAPHY

1– Girard, J. W., and Mesavage, Clement.
Tables for estimating board-foot volume of timber.
U. S. Dept. Agr., Forest Service. 94 pp. 1946.

2– Mesavage, Clement.
Tables for estimating cubic-foot volume of timber.
So. For. Exp. Sta. Occasional Paper No. 111. 71 pp. 1947.

3– Chaiken, L. E., and MacKinney, A. L.
Volume, yield, and growth of loblolly pine in the mid-Atlantic Coastal region.
Appal. For. Exp. Sta. Tech. Note 33. 32 pp. 1939.

4– Schumacher, F. X.
Stacked and solid volume of southeastern pulpwood.
Jour. of Forestry. 44 (8): 579-582. 1946.

5– Miller, R. H.
Measuring green southern yellow pine pulpwood by weight or by cord.
Paper Trade Journal. V. 113. July 17, 1941.

6– Mountain, H. S.
Determining the solid wood volume of four-foot pulpwood stacks.

Table 1A. --Merchantable Cubic Foot Volume using Total Tree Height
(Form Classes 65 - 69)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (cubic feet - inside bark)							
5	1.39	1.74	1.98	2.22				
6	2.09	2.53	2.91	3.23	3.73			
7	3.03	3.61	4.19	4.69	5.27	5.77		
8	4.09	4.73	5.57	6.32	7.06	7.80		
9	5.07	5.95	6.96	7.97	8.85	9.73	10.61	
10		7.49	8.92	10.19	11.46	12.73	13.85	
11		9.17	10.81	12.28	13.74	15.21	16.67	17.95
12		10.80	12.74	14.47	16.42	17.93	19.87	21.60
13		12.99	15.33	17.41	19.49	21.57	23.91	25.99
14			17.81	20.20	22.60	24.99	27.68	30.07
15			20.08	22.80	25.52	28.58	31.64	34.36
16			22.67	25.68	28.69	32.07	35.46	38.46

Table 1B. -- Merchantable Cubic Foot Volume using Merchantable Stem Length
(Form Classes 65 - 69)

Diameter breast high (inches)	Merchantable Length of stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (cubic feet - inside bark)													
5	1.59	1.83	2.08	2.32										
6	2.09	2.41	2.72	3.04	3.35	3.67								
7	2.78	3.20	3.61	4.02	4.44	4.86	5.27	5.68						
8	3.56	4.03	4.62	5.15	5.68	6.21	6.74	7.27	7.80					
9	4.31	4.94	5.57	6.20	6.83	7.46	8.09	8.72	9.35	9.98	10.61			
10	5.42	6.22	7.01	7.80	8.60	9.40	10.19	10.98	11.78	12.58	13.37	14.16		
11	6.60	7.52	8.43	9.35	10.26	11.18	12.09	13.01	13.92	14.84	15.75	16.67	17.58	
12	7.78	8.86	9.94	11.02	12.10	13.18	14.26	15.34	16.42	17.50	18.58	19.66	20.74	21.82
13	9.09	10.39	11.69	12.99	14.29	15.59	16.89	18.19	19.49	20.79	22.09	23.39	24.68	25.97
14	10.64	12.13	13.63	15.12	16.62	18.11	19.61	21.10	22.60	24.09	25.59	27.08	28.58	30.07
15	11.92	13.62	15.32	17.02	18.72	20.42	22.12	23.82	25.52	27.22	28.92	30.62	32.32	34.02
16	13.65	15.53	17.41	19.29	21.17	23.05	24.93	26.81	28.69	30.57	32.45	34.33	36.21	38.09

Form Class
72
Cubic Feet
Total Height

Table 2A.--Merchantable Cubic Foot Volume using Total Tree Height
(Form Classes 70 - 74)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (cubic feet - inside bark)							
5	1.47	1.86	2.14	2.42				
6	2.32	2.84	3.29	3.66	4.27			
7	3.31	3.98	4.66	5.23	5.90	6.48		
8	4.70	5.46	6.47	7.35	8.23	9.11		
9	5.87	6.90	8.08	9.25	10.28	11.31	12.34	
10		8.55	10.20	11.66	13.13	14.59	15.87	
11		10.23	12.12	13.80	15.48	17.16	18.84	20.31
12		12.25	14.52	16.53	18.80	20.56	22.83	24.85
13		14.75	17.44	19.84	22.23	24.62	27.31	29.70
14			20.33	23.12	25.92	28.71	31.85	34.64
15			22.98	26.14	29.29	32.83	36.38	39.53
16			26.01	29.54	33.08	37.06	41.04	44.57

Table 2B.--Merchantable Cubic Foot Volume using Merchantable Stem Length
(Form Classes 70 - 74)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (cubic feet - inside bark)													
5	1.70	1.9	2.26	2.54										
6	2.32	2.69	3.07	3.44	3.82	4.19								
7	3.02	3.50	3.98	4.46	4.94	5.42	5.90	6.38						
8	4.07	4.70	5.33	5.96	6.59	7.22	7.85	8.48	9.11					
9	4.99	5.72	6.46	7.20	7.93	8.66	9.40	10.13	10.87	11.60	12.34			
10	6.17	7.09	8.00	8.92	9.83	10.75	11.66	12.58	13.49	14.41	15.32	16.24		
11	7.29	8.34	9.39	10.44	11.49	12.54	13.59	14.64	15.69	16.74	17.79	18.84	19.89	
12	8.72	9.98	11.24	12.50	13.76	15.02	16.28	17.54	18.80	20.06	21.32	22.58	23.84	25.10
13	10.27	11.76	13.26	14.75	16.25	17.74	19.24	20.73	22.23	23.72	25.22	26.71	28.21	29.70
14	11.96	13.70	15.45	17.19	18.94	20.68	22.43	24.17	25.92	27.66	29.41	31.15	32.90	34.64
15	13.53	15.50	17.47	19.44	21.41	23.38	25.35	27.32	29.29	31.26	33.23	35.20	37.17	39.14
16	15.40	17.61	19.82	22.03	24.24	26.45	28.66	30.87	33.08	35.29	37.50	39.71	41.92	44.13

Table 3A. --Merchantable Cubic Foot Volume using Total Tree Height
(Form Classes 75 - 79)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (cubic feet - inside bark)							
5	1.62	2.06	2.37	2.69				
6	2.62	3.23	3.75	4.19	4.88			
7	3.81	4.58	5.35	6.01	6.78	7.44		
8	5.20	6.05	7.19	8.18	9.17	10.17		
9	6.43	7.59	8.91	10.23	11.38	12.54	13.69	
10		9.59	11.48	13.16	14.84	16.52	17.99	
11		11.64	13.85	15.81	17.77	19.73	21.69	23.40
12		13.80	16.42	18.74	21.36	23.40	26.02	28.35
13		16.44	19.50	22.22	24.94	27.66	30.72	33.44
14			22.78	25.93	29.08	32.23	35.78	38.93
15			26.36	30.06	33.75	37.91	42.07	45.76
16			29.28	33.31	37.33	41.86	46.39	50.41

Table 3B. --Merchantable Cubic Foot Volume using Merchantable Stem Length (Form Classes 75 - 79)

Diameter Breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (cubic feet - inside bark)													
5	1.87	2.18	2.50	2.81										
6	2.62	3.06	3.49	3.92	4.36	4.80								
7	3.48	4.03	4.58	5.13	5.68	6.23	6.78	7.33						
8	4.49	5.20	5.91	6.62	7.33	8.04	8.75	9.46	10.17					
9	5.44	6.27	7.09	7.92	8.74	9.57	10.39	11.22	12.04	12.87	13.69			
10	6.86	7.91	8.96	10.01	11.06	12.11	13.16	14.21	15.26	16.31	17.36	18.41		
11	8.21	9.44	10.66	11.89	13.11	14.34	15.56	16.79	18.01	19.24	20.46	21.69	22.91	
12	9.72	11.18	12.63	14.09	15.54	17.00	18.45	19.91	21.36	22.82	24.27	25.73	27.18	28.64
13	11.34	13.04	14.74	16.44	18.14	18.84	21.54	23.24	24.94	26.64	28.34	30.04	31.74	33.44
14	13.32	15.29	17.26	19.23	21.20	23.17	25.14	27.11	29.08	31.05	33.02	34.99	36.96	38.93
15	15.27	17.58	19.89	22.20	24.51	26.82	29.13	31.44	33.75	36.06	38.37	40.68	42.99	45.30
16	17.21	19.73	22.24	24.76	27.27	29.79	32.30	34.82	37.33	39.85	42.36	44.88	47.39	49.91

Table 4A.--Merchantable Cubic Foot Volume using Total Tree Height
(Form Classes 80 - 84)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (cubic feet - inside bark)							
5	1.76	2.26	2.61	2.97				
6	2.83	3.50	4.08	4.56	5.33			
7	4.13	5.01	5.89	6.65	7.53	8.29		
8	5.83	6.78	8.06	9.17	10.28	11.40		
9	7.34	8.67	10.19	11.71	13.04	14.37	15.70	
10		10.80	12.94	14.84	16.75	18.65	20.32	
11		13.00	15.47	17.67	19.87	22.07	24.27	26.20
12		15.25	18.16	20.74	23.65	25.91	28.82	31.40
13		18.62	22.17	25.32	28.47	31.62	35.17	38.32
14			25.65	29.26	32.88	36.50	40.56	44.18
15			29.12	33.22	37.32	41.94	46.56	50.66
16			32.74	37.28	41.81	46.92	52.02	56.55

Table 4B.--Merchantable Cubic Foot Volume using Merchantable Stem Length (Form Classes 80-84)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (outside feet - inside bark)													
5	2.04	2.40	2.75	3.11										
6	2.83	3.31	3.79	4.27	4.75	5.23								
7	3.75	4.38	5.01	5.64	6.27	6.90	7.53	8.16						
8	5.04	5.83	6.63	7.42	8.22	9.01	9.81	10.60	11.40					
9	6.20	7.15	8.10	9.05	10.00	10.95	11.90	12.85	13.80	14.75	15.70			
10	7.70	8.89	10.08	11.27	12.46	13.65	14.84	16.03	17.22	18.41	19.60	20.79		
11	9.15	10.52	11.90	13.27	14.65	16.02	17.40	18.77	20.15	21.52	22.90	24.27	25.65	
12	10.73	12.35	13.96	15.58	17.19	18.81	20.42	22.04	23.65	25.27	26.88	28.50	30.11	31.73
13	12.71	14.68	16.65	18.62	20.59	22.56	24.53	26.50	28.47	30.44	32.41	34.38	36.35	38.32
14	14.80	17.06	19.32	21.58	23.84	26.10	28.36	30.62	32.88	35.14	37.40	39.66	41.92	44.18
15	16.80	19.37	21.93	24.50	27.06	29.63	32.19	34.76	37.32	39.89	42.45	45.02	47.58	50.15
16	19.13	21.97	24.80	27.64	30.47	33.31	36.14	38.98	41.81	44.65	47.48	50.32	53.15	55.99

Table 5A. --Merchantable Cubic Foot Volume using Total Tree Height
(Form Classes 85 - 89)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (cubic feet - inside bark)							
5	2.02	2.60	3.01	3.43				
6	3.18	3.95	4.61	5.16	6.04			
7	4.67	5.67	6.66	7.51	8.51	9.36		
8	6.50	7.57	8.98	10.22	11.46	12.70		
9	8.12	9.59	11.27	12.95	14.42	15.89	17.36	
10		11.93	14.33	16.47	18.61	20.74	22.62	
11		14.57	17.40	19.92	22.44	24.96	27.48	29.69
12		17.17	20.47	23.40	26.71	29.28	32.58	35.52
13		20.56	24.45	27.90	31.36	34.82	38.70	42.16
14			28.39	32.41	36.44	40.46	44.99	49.01
15			32.36	36.99	41.62	46.83	52.04	56.67
16			36.42	41.50	46.59	52.32	58.04	63.13

Table 5B.--Merchantable Cubic Foot Volume using Merchantable Stem Length
(Form Classes 85 - 89)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (outside feet - inside bark)													
5	2.35	2.76	3.18	3.59										
6	3.18	3.73	4.28	4.83	5.38	5.93								
7	4.25	4.96	5.67	6.38	7.09	7.80	8.51	9.22						
8	5.62	6.50	7.39	8.28	9.16	10.05	10.93	11.82	12.70					
9	6.86	7.91	8.96	10.00	11.06	12.11	13.16	14.21	15.26	16.31	17.36			
10	8.46	9.80	11.13	12.46	13.80	15.14	16.47	17.80	19.14	20.48	21.81	23.14		
11	10.16	11.73	13.31	14.88	16.46	18.03	19.61	21.18	22.76	24.33	25.91	27.48	29.06	
12	12.03	13.86	15.70	17.53	19.37	21.20	23.04	24.87	26.71	28.58	30.38	32.21	34.05	35.88
13	14.08	16.24	18.40	20.56	22.72	24.88	27.04	29.20	31.36	33.52	35.68	37.84	40.00	42.16
14	16.32	18.83	21.35	23.86	26.38	28.89	31.41	33.92	36.44	38.95	41.47	43.98	46.50	49.01
15	18.46	21.36	24.25	27.14	30.04	32.94	35.83	38.72	41.62	44.52	47.41	50.30	53.20	56.10
16	21.15	24.33	27.51	30.69	33.87	37.05	40.23	43.41	46.59	49.77	52.95	56.13	59.31	62.49

Table 6A.--Merchantable Rough Cord Volume using Total Tree Height
(Form Classes 65 - 69)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.020	0.025	0.028	0.032				
6	0.029	0.035	0.040	0.045	0.052			
7	0.041	0.049	0.057	0.065	0.072	0.078		
8	0.055	0.063	0.074	0.084	0.094	0.104		
9	0.066	0.078	0.091	0.104	0.116	0.128	0.139	
10		0.097	0.115	0.132	0.148	0.165	0.179	
11		0.117	0.138	0.156	0.175	0.194	0.212	0.229
12		0.136	0.160	0.182	0.207	0.226	0.250	0.272
13		0.162	0.191	0.217	0.243	0.269	0.295	0.324
14			0.221	0.250	0.280	0.309	0.343	0.372
15			0.247	0.280	0.313	0.351	0.389	0.422
16			0.277	0.313	0.350	0.391	0.433	0.469

Table 6B.--Merchantable Rough Cord Volume using Merchantable Stem Length
(Form Classes 65 - 69)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.023	0.026	0.029	0.033										
6	0.029	0.033	0.038	0.042	0.046	0.051								
7	0.038	0.043	0.049	0.055	0.060	0.066	0.072	0.077						
8	0.047	0.055	0.062	0.069	0.076	0.083	0.090	0.097	0.104					
9	0.057	0.065	0.073	0.081	0.090	0.098	0.106	0.114	0.123	0.131	0.139			
10	0.070	0.080	0.091	0.101	0.111	0.121	0.132	0.142	0.152	0.162	0.173	0.183		
11	0.084	0.096	0.107	0.119	0.131	0.142	0.154	0.166	0.177	0.189	0.201	0.212	0.224	
12	0.098	0.111	0.125	0.139	0.152	0.166	0.179	0.193	0.207	0.220	0.234	0.247	0.261	0.275
13	0.113	0.130	0.146	0.162	0.178	0.195	0.211	0.227	0.243	0.259	0.276	0.292	0.308	0.324
14	0.132	0.150	0.169	0.187	0.206	0.224	0.243	0.261	0.280	0.298	0.317	0.335	0.354	0.372
15	0.146	0.167	0.188	0.209	0.230	0.251	0.272	0.293	0.313	0.334	0.355	0.376	0.397	0.418
16	0.167	0.189	0.212	0.235	0.258	0.281	0.304	0.327	0.350	0.373	0.396	0.419	0.442	0.465

Table 7A.--Merchantable Rough Cord Volume using Total Tree Height
(Form Classes 70-74)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.021	0.026	0.030	0.034				
6	0.032	0.039	0.046	0.051	0.059			
7	0.045	0.054	0.063	0.071	0.080	0.088		
8	0.063	0.073	0.086	0.098	0.110	0.121		
9	0.077	0.090	0.106	0.121	0.135	0.148	0.162	
10		0.110	0.132	0.151	0.170	0.188	0.205	
11		0.130	0.154	0.176	0.197	0.219	0.240	0.259
12		0.154	0.183	0.208	0.237	0.259	0.287	0.313
13		0.184	0.218	0.248	0.277	0.307	0.341	0.371
14			0.252	0.286	0.321	0.355	0.394	0.429
15			0.282	0.321	0.360	0.403	0.447	0.485
16			0.317	0.360	0.404	0.452	0.501	0.544

Table 7B.--Merchantable Rough Cord Volume using Merchantable Stem Length
(Form Classes 70 - 74)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.024	0.028	0.032	0.036										
6	0.032	0.037	0.043	0.048	0.053	0.058								
7	0.041	0.048	0.054	0.061	0.067	0.074	0.080	0.087						
8	0.054	0.063	0.071	0.079	0.088	0.096	0.105	0.113	0.121					
9	0.065	0.075	0.085	0.094	0.104	0.114	0.123	0.133	0.142	0.152	0.162			
10	0.080	0.092	0.103	0.115	0.127	0.139	0.151	0.162	0.174	0.186	0.198	0.210		
11	0.093	0.106	0.120	0.133	0.146	0.160	0.173	0.186	0.200	0.213	0.227	0.240	0.253	
12	0.110	0.126	0.142	0.157	0.173	0.189	0.205	0.221	0.237	0.253	0.268	0.284	0.300	0.316
13	0.128	0.147	0.165	0.184	0.203	0.221	0.240	0.259	0.277	0.296	0.315	0.333	0.352	0.371
14	0.148	0.170	0.191	0.213	0.234	0.256	0.278	0.299	0.321	0.342	0.364	0.386	0.407	0.429
15	0.166	0.190	0.215	0.239	0.263	0.287	0.311	0.335	0.360	0.384	0.408	0.432	0.456	0.481
16	0.188	0.215	0.242	0.269	0.296	0.323	0.350	0.377	0.404	0.431	0.458	0.484	0.511	0.538

Table 8A.--Merchantable Rough Cord Volume using Total Tree Height
(Form Classes 75 - 79)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.023	0.029	0.034	0.038				
6	0.036	0.045	0.052	0.058	0.068			
7	0.052	0.062	0.073	0.082	0.092	0.101		
8	0.069	0.081	0.096	0.109	0.122	0.136		
9	0.084	0.099	0.117	0.134	0.149	0.164	0.180	
10		0.124	0.148	0.170	0.192	0.213	0.232	
11		0.148	0.176	0.201	0.226	0.251	0.276	0.298
12		0.174	0.207	0.236	0.269	0.295	0.328	0.357
13		0.205	0.243	0.277	0.311	0.345	0.384	0.417
14			0.282	0.321	0.360	0.399	0.443	0.482
15			0.324	0.369	0.414	0.466	0.517	0.562
16			0.357	0.407	0.455	0.511	0.566	0.627

Table 8B.--Merchantable Rough Cord Volume using Merchantable Stem Length
(Form Classes 75 - 79)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.026	0.031	0.035	0.040										
6	0.036	0.042	0.048	0.054	0.060	0.067								
7	0.047	0.055	0.062	0.070	0.077	0.085	0.092	0.100						
8	0.060	0.069	0.079	0.088	0.098	0.107	0.117	0.126	0.136					
9	0.071	0.082	0.093	0.104	0.115	0.125	0.136	0.147	0.158	0.169	0.180			
10	0.089	0.102	0.116	0.129	0.143	0.156	0.170	0.184	0.197	0.211	0.224	0.238		
11	0.105	0.120	0.136	0.151	0.167	0.183	0.198	0.214	0.229	0.245	0.261	0.276	0.292	
12	0.122	0.141	0.159	0.177	0.196	0.214	0.232	0.251	0.269	0.287	0.306	0.324	0.342	0.361
13	0.142	0.163	0.184	0.205	0.226	0.248	0.269	0.290	0.311	0.333	0.354	0.375	0.396	0.417
14	0.165	0.189	0.214	0.238	0.262	0.287	0.311	0.336	0.360	0.384	0.409	0.433	0.458	0.482
15	0.188	0.216	0.244	0.273	0.301	0.329	0.358	0.386	0.414	0.443	0.471	0.500	0.528	0.556
16	0.210	0.241	0.271	0.302	0.333	0.363	0.394	0.425	0.455	0.486	0.517	0.547	0.578	0.609

Table 9A. --Merchantable Rough Cord Volume using Total Tree Height
(Form Classes 80-84)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.025	0.032	0.037	0.042				
6	0.039	0.049	0.057	0.063	0.074			
7	0.056	0.068	0.080	0.090	0.102	0.113		
8	0.078	0.090	0.107	0.122	0.137	0.152		
9	0.096	0.114	0.134	0.154	0.171	0.188	0.206	
10		0.140	0.167	0.192	0.216	0.241	0.263	
11		0.166	0.197	0.225	0.253	0.281	0.309	0.334
12		0.192	0.229	0.261	0.298	0.326	0.363	0.395
13		0.232	0.277	0.316	0.355	0.395	0.439	0.478
14			0.318	0.362	0.407	0.452	0.502	0.547
15			0.358	0.408	0.458	0.515	0.572	0.622
16			0.399	0.455	0.510	0.572	0.635	0.690

Table 9B. --Merchantable Rough Cord Volume using Merchantable Stem Length
(Form Classes 80 - 84)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.029	0.034	0.039	0.044										
6	0.039	0.046	0.053	0.059	0.066	0.073								
7	0.051	0.060	0.068	0.077	0.085	0.094	0.102	0.111						
8	0.067	0.078	0.088	0.099	0.110	0.120	0.131	0.141	0.152					
9	0.081	0.094	0.106	0.119	0.131	0.144	0.156	0.168	0.181	0.193	0.206			
10	0.100	0.115	0.130	0.146	0.161	0.176	0.192	0.207	0.223	0.238	0.253	0.269		
11	0.117	0.134	0.152	0.169	0.187	0.204	0.222	0.239	0.257	0.274	0.292	0.309	0.327	
12	0.135	0.155	0.176	0.196	0.216	0.237	0.257	0.277	0.298	0.318	0.338	0.359	0.379	0.399
13	0.159	0.183	0.208	0.232	0.257	0.282	0.306	0.331	0.355	0.380	0.405	0.429	0.454	0.478
14	0.183	0.211	0.239	0.267	0.295	0.323	0.351	0.379	0.407	0.435	0.463	0.491	0.519	0.547
15	0.206	0.238	0.269	0.301	0.332	0.364	0.395	0.427	0.458	0.490	0.521	0.553	0.584	0.616
16	0.233	0.268	0.303	0.337	0.372	0.406	0.441	0.476	0.510	0.545	0.579	0.614	0.648	0.683

Table 10A. --Merchantable Rough Cord Volume using Total Tree Height (Form Classes 85-89)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Pulpwood Volume (Rough Cords)							
5	0.029	0.037	0.043	0.049				
6	0.044	0.055	0.064	0.072	0.084			
7	0.064	0.077	0.091	0.102	0.116	0.127		
8	0.087	0.101	0.120	0.136	0.153	0.169		
9	0.106	0.126	0.148	0.170	0.189	0.208	0.228	
10		0.154	0.185	0.213	0.240	0.268	0.292	
11		0.186	0.222	0.254	0.286	0.318	0.350	0.378
12		0.216	0.258	0.295	0.336	0.368	0.410	0.447
13		0.257	0.305	0.348	0.391	0.434	0.483	0.526
14			0.351	0.401	0.451	0.501	0.557	0.607
15			0.397	0.454	0.511	0.575	0.639	0.696
16			0.444	0.506	0.568	0.638	0.708	0.770

Table 10B. --Merchantable Rough Cord Volume using Merchantable Stem Length
(Form Classes 85 - 89)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Pulpwood Volume (Rough Cords)													
5	0.033	0.039	0.045	0.051										
6	0.044	0.052	0.059	0.067	0.075	0.082								
7	0.058	0.067	0.077	0.087	0.096	0.106	0.116	0.125						
8	0.075	0.087	0.099	0.110	0.122	0.134	0.146	0.157	0.169					
9	0.090	0.104	0.117	0.131	0.145	0.159	0.172	0.186	0.200	0.214	0.228			
10	0.109	0.127	0.144	0.161	0.178	0.196	0.213	0.230	0.247	0.265	0.282	0.299		
11	0.129	0.149	0.170	0.190	0.210	0.230	0.250	0.270	0.290	0.310	0.330	0.350	0.370	
12	0.151	0.175	0.198	0.221	0.244	0.267	0.290	0.313	0.336	0.360	0.382	0.406	0.429	0.452
13	0.176	0.203	0.230	0.257	0.284	0.311	0.337	0.364	0.391	0.418	0.445	0.472	0.499	0.526
14	0.202	0.233	0.264	0.295	0.327	0.358	0.389	0.420	0.451	0.482	0.513	0.544	0.576	0.607
15	0.227	0.262	0.298	0.333	0.369	0.404	0.440	0.476	0.511	0.547	0.582	0.618	0.653	0.689
16	0.258	0.297	0.336	0.374	0.413	0.452	0.491	0.530	0.568	0.607	0.646	0.685	0.724	0.762

Table 11A. --Trees per Rough Cord using Total Tree Height
(Form Classes 65 - 69)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Number of Trees per Rough Cord of Pulpwood							
5	50	40	36	31				
6	34	29	25	22	19			
7	24	20	18	15	14	13		
8	19	16	14	12	11	10		
9	15	13	11	10	9	8	6	
10		10	9	8	7	6	6	
11		9	7	6	6	5	5	4
12		7	6	5	5	4	4	4
13		6	5	5	4	4	3	3
14			5	4	4	3	3	3
15			4	4	3	3	3	2
16			4	3	3	3	2	2

Form Class

67

Trees per Cord
Merchantable
Height

Table 11B. --Trees per Rough Cord using Merchantable Stem Length
(Form Classes 65 - 69)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	43	38	34	30										
6	34	30	26	24	22	20								
7	26	23	20	18	17	15	14	13						
8	21	18	16	14	13	12	11	10	10					
9	18	15	14	12	11	10	9	9	8	8	7			
10	14	12	11	10	9	8	8	7	7	6	6	5		
11	12	10	9	8	8	7	6	6	5	5	5	5	4	
12	10	9	8	7	7	6	6	5	5	5	4	4	4	4
13	9	8	7	6	6	5	5	4	4	4	4	3	3	3
14	8	7	6	5	5	5	4	4	4	3	3	3	3	3
15	7	6	5	5	4	4	4	3	3	3	3	3	3	2
16	6	5	5	4	4	4	3	3	3	3	3	2	2	2

Table 12A. --Trees per Rough Cord using Total Tree Height
(Form Classes 70 - 74)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Number of Trees per Rough Cord of Pulpwood							
5	48	38	33	29				
6	31	26	22	20	17			
7	22	19	16	14	12	11		
8	16	14	12	10	9	8		
9	13	11	9	8	7	7	6	
10		9	8	7	6	5	5	
11		8	6	6	5	5	4	4
12		6	5	5	4	4	3	3
13		5	5	4	4	3	3	3
14			4	3	3	3	3	2
15			4	3	3	2	2	2
16			3	3	2	2	2	2

Form Class
72
Trees per Cord
Merchantable
Height

Table 12B.--Trees per Rough Cord using Merchantable Stem Length
(Form Classes 70 - 74)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	42	36	31	28										
6	31	27	23	21	19	17								
7	24	21	19	16	15	14	12	11						
8	19	16	14	13	11	10	10	9	8					
9	15	13	12	11	10	9	8	8	7	7	6			
10	12	11	10	9	8	7	7	6	6	5	5	5		
11	11	9	8	8	7	6	6	5	5	5	4	4	4	
12	9	8	7	6	6	5	5	5	4	4	4	4	3	3
13	8	7	6	5	5	5	4	4	4	3	3	3	3	3
14	7	6	5	5	4	4	4	3	3	3	3	3	2	2
15	6	5	5	4	4	3	3	3	3	3	2	2	2	2
16	5	5	4	4	3	3	3	3	2	2	2	2	2	2

Table 13A.--Trees per Rough Cord using Total Tree Height
(Form Classes 75 - 79)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Number of Trees per Rough Cord of Pulpwood							
5	43	34	29	26				
6	28	22	19	17	14			
7	19	16	14	12	11	10		
8	14	12	10	9	8	7		
9	12	10	9	7	7	6	6	
10		8	7	6	5	5	4	
11		7	6	5	4	4	4	3
12		6	5	4	4	3	3	3
13		5	4	4	3	3	3	2
14			4	3	3	3	2	2
15			3	3	2	2	2	2
16			3	2	2	2	2	2

Form Class

77

Trees per Cord
Merchantable
Height

Table 13B.--Trees per Rough Cord using Merchantable Stem Length
(Form Classes 75 - 79)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	38	32	29	25										
6	28	24	21	19	17	15								
7	21	18	16	14	13	12	11	10						
8	17	14	13	11	10	9	9	8	7					
9	14	12	11	10	9	8	7	7	6	6	6			
10	11	10	9	8	7	6	6	5	5	5	4	4		
11	10	8	7	7	6	5	5	5	4	4	4	4	3	
12	8	7	6	6	5	5	4	4	4	3	3	3	3	3
13	7	6	5	5	4	4	4	3	3	3	3	3	3	2
14	6	5	5	4	4	3	3	3	3	3	2	2	2	2
15	5	5	4	4	3	3	3	3	2	2	2	2	2	2
16	5	4	4	3	3	3	3	2	2	2	2	2	2	2

Table 14A. --Trees per Rough Cord using Total Tree Height
(Form Classes 80 - 84)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Number of Trees per Rough Cord of Pulpwood							
5	40	31	27	24				
6	26	20	18	16	14			
7	18	15	13	11	10	9		
8	13	11	9	8	7	7		
9	10	9	7	6	6	5	5	
10		7	6	5	5	4	4	
11		6	5	4	4	4	3	3
12		5	4	4	3	3	3	3
13		4	4	3	3	3	2	2
14			3	3	2	2	2	2
15			3	2	2	2	2	2
16			3	2	2	2	2	1

Table 14B.--Trees per Rough Cord using Merchantable Stem Length
(Form Classes 80 - 84)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	34	29	26	23										
6	26	22	19	17	15	14								
7	20	17	15	13	12	11	10	9						
8	15	13	11	10	9	8	8	7	7					
9	12	11	9	8	8	7	6	6	6	5	5			
10	10	9	8	7	6	6	5	5	4	4	4	4		
11	9	7	7	6	5	5	5	4	4	4	3	3	3	
12	7	6	6	5	5	4	4	4	3	3	3	3	3	3
13	6	5	5	4	4	4	3	3	3	3	2	2	2	2
14	5	5	4	4	3	3	3	3	2	2	2	2	2	2
15	5	4	4	3	3	3	3	2	2	2	2	2	2	2
16	4	4	3	3	3	2	2	2	2	2	2	2	2	1

Form Class
82
Trees per Cord
Merchantable
Height

Table 15A. --Trees per Rough Cord using Total Tree Height
(Form Classes 85 - 89)

Diameter breast high (inches)	Total Tree Height (feet)							
	30	40	50	60	70	80	90	100
	Number of Trees per Rough Cord of Pulpwood							
5	24	27	23	20				
6	23	18	16	14	12			
7	16	13	11	10	9	8		
8	11	10	8	7	7	6		
9	9	8	7	6	5	5	4	
10		6	5	5	4	4	3	
11		5	5	4	3	3	3	
12		5	4	3	3	3	2	2
13		4	3	3	3	2	2	2
14			3	2	2	2	2	2
15			3	2	2	2	2	1
16			2	2	2	2	1	1

Table 15B.--Trees per Rough Cord using Merchantable Stem Length
(Form Classes 85 - 89)

Diameter breast high (inches)	Merchantable Length of Stem (feet)													
	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	Number of Trees per Rough Cord of Pulpwood													
5	30	26	22	20										
6	23	19	17	15	13	12								
7	17	15	13	11	10	9	9	8						
8	13	11	10	9	8	7	7	6	6					
9	11	10	9	8	7	6	6	5	5	5	4			
10	9	8	7	6	6	5	5	4	4	4	4	3		
11	8	7	6	5	5	4	4	4	3	3	3	3	3	
12	7	6	5	5	4	4	3	3	3	3	3	2	2	2
13	6	5	4	4	4	3	3	3	3	2	2	2	2	2
14	5	4	4	3	3	3	3	2	2	2	2	2	2	2
15	4	4	3	3	3	2	2	2	2	2	2	2	2	1
16	4	3	3	3	2	2	2	2	2	2	2	1	1	1

TECHNOLOGY AND SCIENCE ROOM

LOUISIANA BULLETIN NO. 446 SEPTEMBER 1950

Dehydrated Sweet Potato Meal For Fattening Steers

BY

C. B. SINGLETARY, S. E. MCCRAINE, AND LEE BERWICK

TECHNOLOGY AND SCIENCE ROOM

Angus Yearlings Fed Out on Sweet Potato Meal

UNIVERSITY OF MARYLAND
LIBRARY
MAR 27 1951

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
Agricultural Experiment Station
W. G. Taggart, Director

Dehydrated Sweet Potato Meal For Fattening Steers

C. B. SINGLETARY, S. E. MCCRAINE AND LEE BERWICK*

The value of dehydrated sweet potatoes as a carbohydrate feed for fattening calves has been under investigation at the Louisiana Station for three years. The three main problems involved in this investigation were: first, to determine whether dehydrated sweet potatoes could be used successfully in fattening cattle; second, a determination of the relative value of dehydrated potatoes in comparison with corn; and third, whether or not dehydrated potatoes could be fed as the only carbohydrate feed together with cottonseed meal.

At the time that the work was begun, large quantities of sweet potatoes were being produced in Louisiana and there were many thousands of bushels of low-grade potatoes on hand for which there was not a ready market. The sweet potato growers went in very strongly for dehydrating plants to turn these low-grade potatoes into a marketable feed for livestock. Consequently, it was of considerable importance to learn how satisfactory this product would be for livestock feeding.

Experimental Procedure and Results

The first experiment was considered a preliminary feeding test. Eighteen high-grade Angus and Hereford calves averaging 418 pounds were identified individually and divided into two uniform groups according to weight, sex, breed and grade and placed in lots I and II. (See Table I for rations fed.)

TABLE I. Rations Used in the First Feeding Experiment

Concentrate Feeds	Number of Pounds	Dry Matter	Digestible Protein	Total Digestible Nutrients
Lot I				
Yellow corn (ground)	80	66.80	5.60	63.20
Cottonseed meal	20	18.60	6.80	14.70
Total	100	85.40	12.40	77.90
LOT II				
Dehydrated sweet potatoes	67	63.07	1.34	53.60
Cottonseed meal (41%)	33	30.69	11.22	24.26
Total	100	93.76	12.56	77.86

CHEMICAL ANALYSIS*

	Corn	Dehydrated Sweet Potatoes
Crude protein	9.00%	4.13%
Fat	3.95	1.32
N.F.E.	70.84	79.77
Crude fiber	3.19	5.27
Water	11.82	5.86
Ash	1.20	3.65

*Chemical analyses were made by Frances L. Bonner of the Fertilizer and Feedstuffs Laboratory.

---

*The authors wish to acknowledge their indebtedness and gratitude to the late Dr. C. I. Bray, under whose direction this study was completed.

Grass hay was kept before the calves at all times except for one day a week when alfalfa was fed. A complete mineral mixture was fed free choice. Salt blocks were at their disposal. This preliminary feeding test had a 90-day duration period ending in April 1947. All calves were slaughtered and graded at the Louisiana State University Animal Industry Building under the supervision of Professors J. B. Francioni, Jr., and R. M. Crown.

From observations made during the first trial, the ground corn seemed to be a great deal more palatable than the dehydrated sweet potatoes. The corn-fed calves consumed 10.06 pounds of concentrate feed daily and made an average daily gain of 1.94 pounds as compared to 9.66 pounds of daily concentrate consumption and 1.61 pounds average daily gain for the potato-fed calves. The results showed that the sweet potato meal was only 86.4 per cent as efficient in producing gains on calves as was the ground corn. The corn-fed lot also had a 2.6 per cent higher average dressing percentage than the sweet potato-fed lot. These differences were attributed largely to the inferior quality of the sweet potato product used.

The second feeding experiment was started in November 1947, using 32 high-grade Angus calves averaging 396 pounds. The same experimental procedure was used in this study as was outlined for the first experiment, except that two intermediate lots were used, making a total of four

TABLE II. Rations for the Second Feeding Experiment

Concentrate Feeds	Number of Pounds	Dry Matter	Digestible Protein	Total Digestible Nutrients
Lot I				
Yellow corn (ground)	80	66.80	5.60	63.20
Cottonseed meal	20	18.60	6.80	14.70
Total	100	85.40	12.40	77.90
Lot II				
Yellow corn (ground)	50	41.75	3.50	39.50
Dehydrated sweet potatoes	25	23.58	0.50	20.00
Cottonseed meal (41%)	25	23.25	8.50	18.38
Total	100	88.58	12.50	77.88
Lot III				
Yellow corn (ground)	20	16.70	1.40	15.80
Dehydrated sweet potatoes	50	47.16	1.00	40.00
Cottonseed meal (41%)	30	27.90	10.20	22.05
Total	100	91.76	12.60	77.85
Lot IV				
Dehydrated sweet potatoes	67	63.20	1.34	53.60
Cottonseed meal (41%)	33	30.69	11.22	24.26
Total	100	93.89	12.56	77.86

CHEMICAL ANALYSIS*

	Corn	Dehydrated Sweet Potatoes
Crude protein	8.31%	6.25%
Fat	3.58	0.94
N.F.E.	68.80	77.76
Crude fiber	1.96	3.93
Water	16.14	5.67
Ash	1.21	5.45

*Chemical analyses were made by Frances L. Bonner of the Fertilizer and Feedstuffs Laboratory.

lots. In each experiment the rations were made up so that the digestible protein and total digestible nutrients would remain constant. (See Table II.)

This feeding trial had a 118-day duration period ending in March 1948. The following after-slaughter data were collected: hot dressing per cent; cold dressing per cent; 48-hour shrinkage; carcass grade; thickness of external fat; distribution of fat; marbling of rib eye; grain of lean; firmness of lean; color of lean; color of fat.

During the second experiment there were no significant differences among lots in the amounts gained or the dressing percentages. (See Table III.) Neither was there any appreciable difference in the appraised value per hundredweight of the live calves, which indicated very little, if any, liveweight grade difference. However, further comparisons were made that showed noteworthy differences.

The carcass grade, thickness of fat, distribution of fat, marbling of rib eye, grain of lean, color of lean, and the per cent cooking shrinkage favored the corn-fed calves.

The dehydrated sweet potato feed was worth 94 per cent as much as corn. As the potato feed cost $65 per ton, compared to corn at $98, the

TABLE III. Second Test—November 5, 1947 to March 1, 1948

(Cattle Feeding Experiment with Corn and Sweet Potato Meal)

118 days — 8 head per lot

Ration	Corn, CS Meal, Hay	Corn 2/3, Sweet Potatoes 1/3, CS Meal, Hay	Corn 1/3, Sweet Potatoes 2/3, CS Meal, Hay	Sweet Potatoes, CS Meal, Hay
Lot Number	I	II	III	IV
Ave. initial weight	396.3	397.5	396.0	394.3
Ave. final weight	603.75	578.75	588.1	578.7
Ave. gain	207.45	181.25	192.1	184.4
Ave. daily gain per head	1.77	1.55	1.64	1.58
Feed in lbs. per day per steer				
Corn	7.90	4.90	1.90	—
Sweet potatoes		2.46	4.75	6.22
Cottonseed meal	1.98	2.46	2.85	3.06
Grass hay	3.51	3.47	3.37	3.29
Alfalfa hay	1.12	1.12	1.13	1.11
Feed in lbs. per 100 lbs. gain				
Corn	449.9	320.4	116.7	—
Sweet potatoes	....	160.2	291.9	398.1
Cottonseed meal	112.4	160.2	175.1	196.1
Grass hay	199.6	226.0	207.1	211.1
Alfalfa hay	63.9	73.1	69.3	71.6
Ave. sale price per cwt.	$24.72	$24.77	$24.92	$24.70
Ave. sale price per steer	149.25	143.36	146.55	142.94
Cost per 100 lbs. gain	31.80	33.58	28.26	27.12
Total cost per steer	130.34	125.25	118.67	114.39
Profit per steer	18.91	18.11	27.88	28.55

Cost of feed per ton: Corn—$98.00; Dehydrated sweet potato meal—$65.00; Cottonseed meal—$98.00; Grass hay—$29.50; Alfalfa hay—$41.00.

calves in Lot IV receiving only dehydrated sweet potatoes and cottonseed meal made the highest profits.

In the winter of 1948-49 a third experiment was conducted following the plan used in 1947-48. In this test crossbred Brahman-Angus and crossbred Africander-Angus calves from the Iberia Experiment Farm were used. They weighed about 400 pounds when bought, but gained between 30 and 40 pounds on pasture before being put on feed. Results are given in Table IV.

TABLE IV. Third Test—November 5, 1948 to March 12, 1949

(Cattle Feeding Experiment with Corn and Sweet Potato Meal)

127 days—8 head per lot

Ration	Corn, CS Meal, Hay	Corn 2/3, Sweet Potatoes 1/3, CS Meal, Hay	Corn 1/3, Sweet Potatoes 2/3, CS Meal, Hay	Sweet Potatoes, CS Meal, Hay
Lot Number	I	II	III	IV
Ave. initial weight	437.5	436.6	437.2	436.3
Ave. final weight	656.2	660.6	647.5	657.5
Ave. gain	218.7	224.0	210.3	221.2
Ave. daily gain per head	1.722	1.764	1.656	1.742
Feed in lbs. per day per steer				
Corn	9.47	5.89	2.33	----
Sweet potatoes	---	2.94	5.83	7.31
Cottonseed meal	2.37	2.94	3.50	3.65
Grass hay	2.78	2.72	2.78	2.40
Alfalfa hay	0.82	0.84	0.84	0.83
Feed in lbs. per 100 lbs. gain				
Corn	549.7	333.9	140.8	----
Sweet potatoes	----	166.9	352.1	419.4
Cottonseed meal	137.4	166.9	211.2	209.7
Grass hay	161.2	154.3	168.1	138.1
Alfalfa hay	47.5	48.0	50.7	47.5

The dehydrated sweet potato meal used in the third test seemed to be of higher quality than that used in the first two tests, and the gains on the sweet potato rations were more satisfactory in comparison with corn. Two of the sweet potato-fed lots, No. II (getting 2 parts of corn to 1 part of sweet potatoes) and No. IV (receiving only dehydrated sweet potatoes and cottonseed meal), made first and second highest gains, respectively, while the corn-fed lot made third highest gains. The relatively lower gains made in the corn-fed lot were due to the fact that two steers in that lot did not do well, presumably because of inferior quality resulting in lower feed utilization. There were no significant differences in gains or dressing percentages between lots. The potatoes lacked the palatability of the corn but they were of excellent quality, and sufficiently large amounts were consumed to produce excellent gains.

While some scouring was noticed among certain individuals in the sweet potato-fed lots, it was not at all excessive and did not seem in any way to interfere significantly with their health. The total feed consumption of the potato-fed lots was less in all experiments than in the corn-fed lot due possibly to the bulky nature of the potatoes or to a lack of palatability. Sudden changes in temperature caused the steers fed only dehydrated sweet potatoes and cottonseed meal to go off feed.

Conclusions

From the data secured under the conditions of these experiments the following conclusions seem warranted:

1. Dehydrated sweet potato meal of good quality, when used as the carbohydrate feed in a balanced ration, was worth 90 to 95 per cent as much as corn for fattening calves. Poor quality meal was not satisfactory.

2. Rations containing sweet potato meal were less palatable and were consumed in smaller amounts than the corn ration.

3. Steers fed a dehydrated sweet potato ration are more likely to go off feed during weather changes than those fed a corn ration.

4. There did not seem to be any difference in the feeding value of the dehydrated potatoes whether fed as 1/3, 2/3 or all of the carbohydrate ration.

5. Evidently there is no particular value in using dried sweet potatoes with corn for fattening cattle.

6. No significant differences could be seen in the liveweight grades; therefore the appraised value per 100 pounds liveweight was practically the same for all lots.

7. Carcass data indicating carcass grades favored the corn-fed calves.

8. There was no appreciable difference in the shrinkage of the different lots, except that the lots making the higher gains naturally showed higher dressing percentages.

9. The chemical analysis of fat samples showed very small differences in the carotene content. The deep yellow color of the fat of the potato-fed calves was due to a water soluble yellow pigment instead of a higher carotene content.

10. If sweet potato meal can be produced at about 90 per cent the price of corn it makes a very satisfactory feed for fattening steers.

TECHNOLOGY AND SCIENCE [illegible]

.447
BLACKSBURG, VIRGINIA

LOUISIANA BULLETIN NO. 447 AUGUST, 1950

Seasonality in Production and Marketing Practices of Louisiana Egg Producers

By

RANDALL STELLY AND JAMES M. BAKER

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

CONTENTS

INTRODUCTION 3

Purpose of the Study 3

Methods of Procedure and Sources of Data 4

Size of the Farm Flock 5

SALES OUTLETS USED BY PRODUCERS 5

Sales by Size of Flock 5

SEASONAL FLUCTUATIONS 6

Seasonal Fluctuations in Production 6

Seasonal Disposition of Eggs 8

Prices Received for Eggs 8

ASSEMBLY AND DELIVERY OF EGGS 11

Grading and Packing for Market 13

Selling Eggs on Basis of Color 13

Knowledge and Source of Market Information 14

FLOCK MANAGEMENT AND EGG PRODUCTION FACILITIES. 15

DISPOSITION OF LOCAL EGGS BY FIRST BUYERS 17

SUMMARY AND CONCLUSIONS 17

Seasonality in Production and Marketing Practices of Louisiana Egg Producers

By

RANDALL STELLY AND JAMES M. BAKER*

INTRODUCTION

The poultry and egg industry is of far-reaching importance in the Louisiana agricultural economy. A survey of Louisiana farmers indicates that 87 per cent of the rural families in the state include the production of eggs as an enterprise in the farm business. The unit of production generally is small, and a large proportion of the eggs are consumed on the farms. However, the amount sold is an important source of income for many farm families. During 1949 the value of eggs produced in Louisiana amounted to $12,578,000 and the cash benefits to producers from the sale of eggs amounted to more than seven million dollars.[1]

Little information has been available on the production and marketing practices of Louisiana egg producers. The farm market supply is seasonal with peak production occurring during the spring months. It is during the spring and summer months that farmers experience the most difficulty in selling eggs. Louisiana farmers are concerned about the wide fluctuations in the price received for their eggs. These fluctuations are caused mainly by seasonal variations in production, and the lack of organized marketing facilities to properly handle the large supply during certain months of the year.

Purpose of the Study

This report is the Louisiana part of a regional egg marketing research project, and deals especially with the egg marketing problems at the farm level in Louisiana.[2] It is designed to contribute information that will be helpful to producers, dealers and others in their efforts to formulate methods and procedures in marketing leading to more orderly disposition of eggs throughout the year and thereby to better regulate the price and probably advance it to a higher yearly average.

The main objectives of the study are: (1) to determine the egg marketing practices and related production methods; (2) to determine the quantity and quality of eggs offered for sale by seasons; (3) to determine both the strong and weak points of present practices as related to farmers' needs; and (4) to relate the findings of the study to improved marketing methods, techniques, and procedures.

---

*Mr. Jerry M. Law, who assisted with the initial phases of this study, resigned July 1, 1949, to become Leader of the Poultry and Egg Marketing Project.

[1] Farm Production, Disposition, Cash Receipts, and Gross Income, Chickens and Eggs, 1948-1949, U.S.D.A., B.A.E., April, 1950.

[2] The nine states cooperating in a regional poultry and egg marketing project are Alabama, Arkansas, Georgia, Louisiana, Mississippi, South Carolina, Tennessee, Texas and Virginia.

Methods of Procedure and Sources of Data

To achieve the objectives of the study, data have been assembled and analyzed on: (1) seasonal variations in egg supplies; (2) disposition of eggs during the different seasons; (3) prices received by seasons; and (4) the types of markets used by producers.

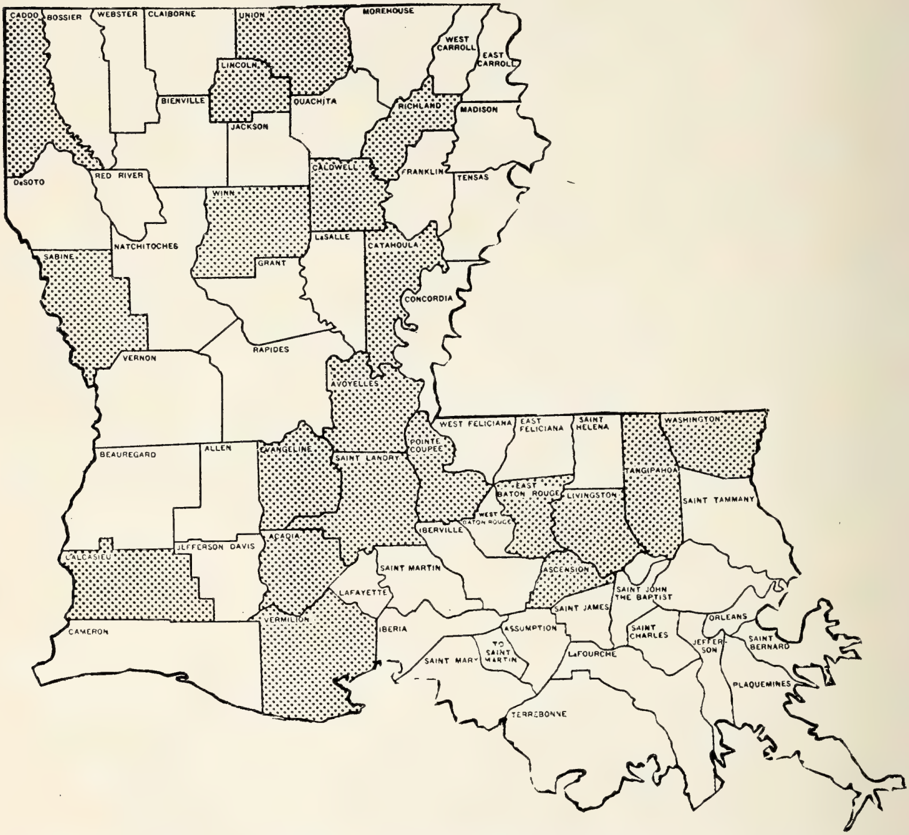


FIG. 1.—Location of Parishes from which Egg Marketing Data Were Obtained.

Detailed information on egg production and marketing practices were obtained from 327 Louisiana egg producing farm families during 1947 and 1948. Data for the year 1947 were gathered by the survey method in 20 Louisiana parishes (Figure 1). The Bureau of Agricultural Economics, United States Department of Agriculture, designed the sample plan used in conducting the survey. Monthly data for 1948 were obtained from producers and first handlers of eggs by mailed questionnaires.

Size of Farm Flock

The average size of flock reported by the flock owners surveyed was 34 hens and pullets as of January 1, 1948. Farmers classified as producers owned flocks averaging 46 hens and pullets. The average size of flock reported by non-producers was 18 birds.[3] Information as to size of flock owned was obtained from 320 of the 327 egg producers. Over 90 per cent of the producers' flocks comprised fewer than 100 birds. Forty-three per cent of the 320 producers owned flocks ranging in size from 25 to 49, and 22 per cent reported having fewer than 25 hens and pullets. Fifty-two per cent of the flocks contained no pullets.

SALES OUTLETS USED BY PRODUCERS

During 1947 and 1948, eggs were sold to eight different types of buyers, namely, country and city retail stores, consumers, rolling stores, local produce dealers, hatcheries, chain stores, hucksters, and institutions such as hotels and restaurants. Retail stores were used by a majority of producers, ranging from 55 per cent of flock owners having 25 to 49 birds to 66 per cent of producers with flocks of 50 to 99 birds. The consumer was second in importance as a market to Louisiana egg producers. It was the principal market for 18 per cent of the owners of flocks under 25 hens in size and for 26 per cent of owners of larger flocks having 100 or more birds. There were no wide differences in patronage between the other market outlets. Chain stores and rolling stores received their local eggs from the small owners, while a greater proportion of the owners of large flocks sold their eggs to institutions and hatcheries.

Sales by Size of Flock

Some variations occurred in the percentage of eggs distributed to the different types of buyers from different sizes of flocks. During 1948, retail stores were the outlet for 66 per cent of the eggs from flocks of 50 to 99 hens and pullets, and 52 per cent from flocks containing fewer than 25 birds (Table 1). Consumers purchased 21 per cent of the eggs sold by small flock owners having fewer than 25 birds and approximately 30 per cent of the eggs sold from flocks having 100 or more hens and pullets. Institutions and hatcheries looked to larger flocks for their local egg purchases because it was more efficient and economical to buy where there were larger concentrations of supply. Retail stores, rolling stores and local produce dealers were the main outlet for the eggs from smaller flocks.

---

[3] For purposes of this study, egg producers are those rural families who expected to sell as many as two dozen eggs during any one of the months of January through June, 1948.

TABLE 1. Percentage of Eggs Sold by 320 Producers to Different Types of Buyers, Louisiana, 1948

Type of Buyer	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & over*	
	Per Cent of Eggs Sold				
Country and city retail stores	51.7	60.9	65.9	57.0	62.4
Consumer	20.7	25.1	18.2	29.5	22.5
Hatchery	.0	.7	2.1	5.6	4.5
Rolling store	12.3	3.2	3.2	.0	2.6
Institution	4.2	1.8	.2	7.9	2.1
Local produce dealer	.0	2.9	2.8	.0	1.6
Huckster	1.1	.6	3.2	.0	1.1
Chain store	9.2	1.2	.4	.0	1.0
Unknown	.8	3.6	4.0	.0	2.2
TOTAL	100.0	100.0	100.0	100.0	100.0

SEASONAL FLUCTUATIONS

The marketing problems encountered by Louisiana egg producers arise primarily from the wide seasonal fluctuations in production by Louisiana flocks. Many local egg dealers lack equipment or readily available markets to handle properly the supply during the peak spring production. Market congestions occur, especially in the areas of small flocks, which account for the unduly low prices received by farmers during such periods. Reducing the seasonal fluctuations in egg production would aid materially in solving the problem of seasonal variations in prices. As indicated by Table 3, larger and better managed flocks tend to achieve greater uniformity of egg production.

Seasonal Fluctuations in Production

The highly seasonal fluctuation in egg production in Louisiana, as indicated by this study, results in 36 per cent of the yearly supply occurring during March, April, and May. Production reaches a peak during March, with 13 per cent of the yearly total, and declines to the lowest point in October, when less than 6 per cent is produced (Table 2). The drop in production for all flocks from the high to the low month was 54 per cent.

Seasonal fluctuation in production is greater among flocks with fewer than 100 layers than among the larger flocks. For the smaller, the drop in production from March to October was 70 per cent, while the decline for flocks of 100 or more birds during the same period was 31 per cent. Almost 40 per cent of the yearly production of the smaller flocks occurred during the spring months of March through May, and

15 per cent during the fall months. For the large flocks, the production during these periods was 27 and 26 per cent, respectively.

TABLE 2. Seasonal Distribution of Eggs Produced, by Size of Flock, Louisiana, 1948

Season	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Spring	37.2	40.4	41.0	27.1	35.8
Summer	20.6	22.7	18.9	20.7	20.8
Fall	16.5	12.1	12.1	25.8	18.6
Winter	25.8	24.8	23.9	26.4	24.8
YEAR	100.0	100.0	100.0	100.0	100.0

Monthly production per 100 hens and pullets for all flocks ranged from 1277 eggs in March to 423 eggs during September. This indicates a drop in the rate of lay of 67 per cent from the high to the low month. Changes in the rate of lay appear to contribute more to seasonal variations in production than changes in the number of hens and pullets. Seasonal variations in the rate of lay were greatest among flocks containing less than 100 layers and smallest with larger flocks. In the small group the drop in the rate of lay from spring to fall was 60 per cent, while the larger flocks experienced a drop of 15 per cent during the same period. For all flocks the rate of lay during the fall months was 55 per cent less than during spring months (Table 3).

Since larger flock owners would have a tendency to put more emphasis on better flock management, follow more of the recommended production practices, etc., it would be expected that the rate of lay would be higher among the larger flocks. However, the data indicate higher yearly average rate of production among the smaller than among the larger flocks. This is probably accountable by the fact that a larger proportion of the large flock owners kept accurate production records during the year than was the case with the smaller flock owners. Also, it appears that there is a tendency among smaller flock owners to over-

TABLE 3. Seasonal Egg Production, by Size of Flock, Louisiana, 1948

Season	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Eggs Produced per Season per 100 Hens and Pullets				
Spring	4168	3281	3059	2541	3171
Summer	2624	2303	1063	1875	1713
Fall	1893	1122	1239	2170	1439
Winter	2658	1908	1902	2688	2066

estimate production. To the extent that the above would be the case, production data received from the large flock owners would have a higher degree of accuracy than data received from the smaller ones.

Uniformity of egg production throughout the year appears to be associated mainly with these practices: (1) early start of chicks, (2) feeding of laying mash throughout the year, and (3) having a large percentage of pullets in the flock. A detailed account of the proportion of producers conforming to the different production practices is shown in Table 4.

TABLE 4. Proportion of Producers Using Certain Production Practices, by Size of Flock, Louisiana, 1947

Practices	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Start chicks by May 1	84.7	91.5	90.6	90.9	89.1
Use lights in laying house	.0	.7	3.5	5.6	2.5
Feed mash 11 - 12 months	12.5	13.5	8.2	33.0	13.8
Confine layers	.0	.7	.0	4.2	.6
Have 60% or more pullets	11.1	11.3	8.2	18.2	10.3

About 90 per cent of all producers interviewed started baby chicks by May 1. Fewer than three per cent used electric lights in the laying house. Fourteen per cent fed laying mash at least eleven months of the year. The fact that a very small proportion of producers feed laying mash all year probably accounts for the large seasonal fluctuations in egg production. High and uniform production of eggs can not be expected until the practice of mash feeding is adopted. Ten per cent reported having 60 per cent or more pullets in their flocks.

Seasonal Disposition of Eggs

During 1948, 62 per cent of the eggs produced in Louisiana were sold, 36 per cent were used in the home, and slightly over 2 per cent were hatched (Table 5).

Variations in the amount of eggs sold followed closely the seasonal variations in production. During 1948, approximately 38 per cent of the eggs were sold in the spring months of March, April, and May, and 18 per cent were sold during the fall months (Table 6). Flock owners having fewer than 100 layers reported greater seasonal variations in sales than owners having flocks of larger sizes. The largest seasonal variations in sales were in flocks ranging in size from 25 to 49 birds. Producers in this group sold 43 per cent of their eggs during the spring months and less than 9 per cent during the fall.

Prices Received for Eggs

Louisiana producers reported receiving an average of 47 cents a dozen for eggs sold during 1948. The average price of 58 cents received

TABLE 5. Monthly Distribution of Eggs Produced According to Disposition, Louisiana, 1948

Month	*Sales*	*Home Use*	*Home Hatching*
	Per Cent	*Per Cent*	*Per Cent*
January	61.5	38.2	.3
February	61.6	37.4	1.0
March	63.5	33.6	2.9
April	62.4	33.8	3.8
May	63.4	33.7	2.9
June	52.7	43.3	4.0
July	52.1	46.7	1.2
August	53.5	42.4	4.1
September	54.6	42.5	2.9
October	67.6	31.4	1.0
November	72.2	27.4	.4
December	68.0	31.5	.5
YEAR	61.8	36.0	2.2

TABLE 6. Seasonal Distribution of Egg Sales, by Size of Flock, Louisiana, 1948

Season	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Spring	41.9	43.0	49.4	24.6	37.8
Summer	21.2	23.7	11.3	19.6	17.8
Fall	14.6	8.8	14.6	24.8	17.6
Winter	22.3	24.5	24.7	31.0	26.8
YEAR	100.0	100.0	100.0	100.0	100.0

at hatcheries was higher than the prices received from sales to any other type of buyer. The next highest average prices were received from sales to chain stores and consumers at 55 cents and 51 cents, respectively. The eggs bringing the lowest price were sold to hucksters at 40 cents a dozen (Table 7).

Egg prices changed during 1948 inversely with seasonal variation in egg production (Figure 2). The monthly average prices reached the lowest point during March and remained below the yearly average through the spring months when production was at its highest level. As production declined during the fall and winter months prices increased, reaching their highest level during the winter months. The highest average monthly price was reported received during December. The very large demand for eggs a few days preceding the holiday season probably accounts for the relatively high prices received by farmers during that month. Although there was a somewhat rapid decline in egg production during the summer months, prices tended to rise slowly. This may be due to the relatively low quality of eggs marketed during that period of the year.

TABLE 7. Monthly Prices Received by Producers for Eggs, by Type of Buyer, Louisiana, 1948
(Weighted Average)

Month	*City stores*	*Country stores*	*Chain stores*	*Rolling stores*	*Hucksters*	*Consumers*	*Hatcheries*	*All buyers*
	cents per doz.	*cents per doz.*	*cents per doz.*	*cents per doz.*	*cents per doz.*	*cents per doz.*	*cents per doz.*	*cents per doz.*
January	47	53	..	..	..	58	..	50
February	47	42	..	42	..	52	..	47
March	34	40	..	..	..	40	..	37
April	36	41	..	20	..	41	90	39
May	35	38	..	40	..	41	40	38
June	39	32	50	..	40	43	45	39
July	44	36	35	..	..	44	..	43
August	49	41	..	..	..	53	..	48
September	53	49	62	..	..	51	..	52
October	54	54	65	..	..	58	..	55
November	48	58	..	70	..	59	..	54
December	78	79	..	..	..	69	..	75
YEAR	46.0	45.9	55.0	43.0	40.0	50.8	58.3	47.3

The problem of Louisiana producers in the marketing of eggs would be much simplified if production were at a more uniform rate throughout the year. Because of the high rate of production during the spring months which results in local market congestion, Louisiana

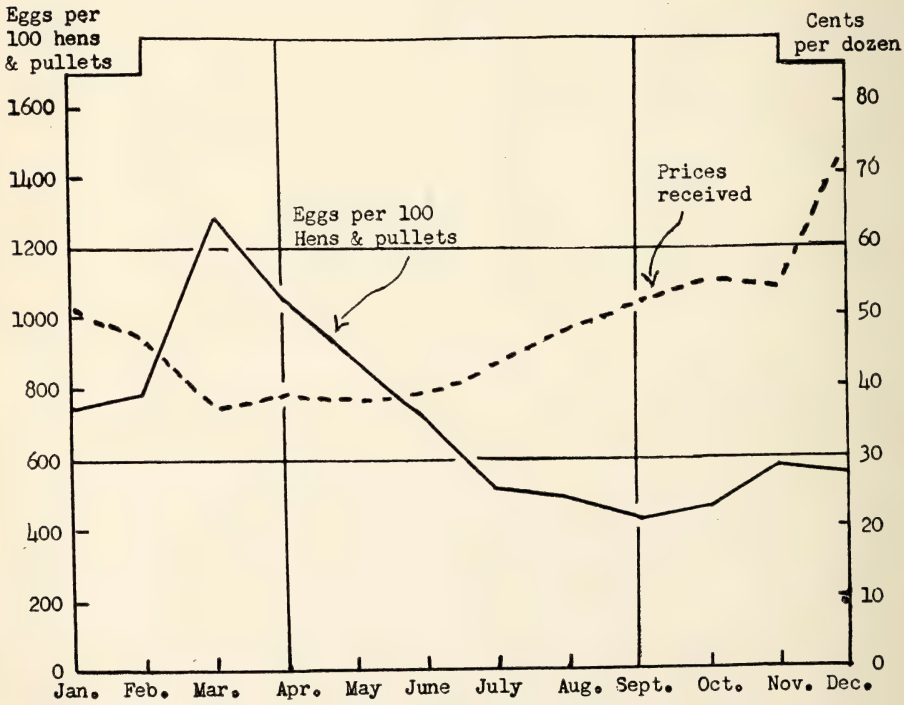


FIG. 2.—Seasonality of Egg Production and Prices, Louisiana, 1948.

egg producers experience great difficulties in marketing eggs at favorable prices at that time.

ASSEMBLY AND DELIVERY OF EGGS

Sixty-six per cent of Louisiana egg producers contacted delivered eggs to some type of market during 1947. Over 83 per cent of those producers delivered eggs to city and country retail stores, 6 per cent delivered to consumers, and 11 per cent to all other types of buyers combined. The average distance traveled by producers in making the egg deliveries was 5.7 miles (Table 8).

TABLE 8. Per Cent of Producers Delivering Eggs to Various Outlets and Average Distance from Producer to Outlet, Louisiana, 1947

Type of Outlet	*Producers Delivering Eggs*	*Average Distance to Outlet**
	Per Cent	*Mile*
Country and city retail stores	55.0	4.6
Chain stores	1.2	9.5
Institutions	1.2	5.3
Hatcheries	1.5	9.6
Consumers	3.7	12.8
Rolling stores	.9	3.5
Hucksters	.3	1.5
Produce dealers	2.2	11.3
All buyers	66.0	5.7

*Weighted by the number of producers delivering various distances to each outlet.

Distance to market appears to have little effect on frequency of selling eggs. Other matters that cause producers to make trips to market seem to have a greater effect on the frequency of marketing eggs. Over 75 per cent of the egg producers marketed eggs at least once a week during 1947, 24 per cent sold twice weekly, and less than 3 per cent sold eggs daily during the entire year (Table 9). The information indicates very little, if any, extra effort made to market eggs more frequently during the spring and summer months when it is almost impossible to preserve the quality of eggs over an extended period without proper refrigeration.

During 1947, the number of eggs delivered to market by producers amounted to 69 per cent of the total eggs sold. Egg producers reported selling their eggs at their households to three different types of buyers only. Of the eggs sold at producer households, 22 per cent were to consumers, 47 per cent to rolling stores, and 31 per cent were sold to hucksters. All the eggs sold to other types of buyers were delivered by producers.

TABLE 9. Distribution of Egg Producers Selling Eggs at Various Time Intervals and Distances from Principal Outlet, Louisiana, 1947

Frequency of Selling	*Sold at Farm*	*Distance to Principal Outlet*						*Total*
		Less than 1 mile	*1.0 to 5.9 miles*	*6.0 to 11.9 miles*	*12.0 to 17.9 miles*	*18 and more miles*	*Not ascertained*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Daily entire year	1.9	5.2	2.5	2.4	.0	.0	2.1	2.4
Every other day entire year	3.8	15.9	2.5	4.8	.0	20.0	4.3	5.1
Twice weekly entire year	23.1	26.7	23.7	20.4	28.4	10.0	24.8	23.5
Weekly entire year	41.2	36.6	43.0	41.6	55.4	60.0	49.7	44.2
Weekly spring and summer	7.4	.0	9.8	7.1	.0	10.0	.0	5.9
Weekly fall and winter	9.3	7.9	1.7	11.7	16.2	.0	2.1	6.0
Bi-weekly spring and summer	1.9	2.5	3.4	4.8	.0	.0	2.1	2.7
Bi-weekly fall and winter	1.9	.0	2.5	4.8	.0	.0	.0	1.8
Irregularly	3.8	.0	4.2	2.4	.0	.0	6.4	3.3
Other	3.8	5.2	5.9	.0	.0	.0	6.4	4.2
Not ascertained	1.9	.0	.8	.0	.0	.0	2.1	.9
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Grading and Packing for Market

Eighty-nine per cent of producers interviewed reported selling eggs on an ungraded basis the entire year. Only one per cent reported no current receipt sales. It is assumed therefore that producers having no current receipt sales disposed of their eggs on a graded basis. Around three-fourths of the producers who either sold all their eggs on a graded basis or sold them as current receipts only part of the year were those owning larger flocks (Table 10).[4]

TABLE 10. Distribution of Egg Producers Selling Eggs on a Current Receipt Basis, by Size of Flock, Louisiana, 1947

Size of Flock	*Current Receipt Entire Year*	*Current Receipt Part of Year*	*No Current Receipt Sales*	*Not Ascertained*
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*
Under 25	88.9	4.2	.0	6.9
25 - 49	92.2	2.8	.0	5.0
50 - 99	94.2	3.5	.0	2.3
100 & over	62.9	11.1	14.9	11.1
All Flocks	89.3	4.3	1.2	5.2

Selling Eggs on Basis of Color

Selling eggs according to color appears to be of little consequence at the first buyer level since approximately 87 per cent of Louisiana producers reported selling eggs of mixed colors and made no attempt to separate their eggs according to color (Table 11).

Sorting eggs according to color before selling them is practiced more widely among large flock owners than among small flock owners. The percentage of producers selling all white or all brown eggs increased as size of flock owned increased. Conversely, the proportion of producers selling eggs of mixed colors declined steadily from the smaller to the larger flock owners.

TABLE 11. Distribution of Egg Producers as to Color of Eggs Sold, by Size of Flock, Louisiana, 1947

Size of Flock	*Color of Eggs*				*Total*
	White	*Brown*	*Mixed*	*Not Ascertained*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Under 25	2.8	5.6	90.2	1.4	100.0
25 - 49	4.3	6.4	89.3	.0	100.0
50 - 99	1.2	14.9	83.9	.0	100.0
100 & over	14.8	11.1	74.1	.0	100.0
All Flocks	4.0	8.8	86.9	.3	100.0

Concerning the methods used for packing eggs for market, the data reveal that about 90 per cent of the producers sold eggs in buckets, boxes, paper sacks and other miscellaneous containers, 6 per cent sold eggs in wooden cases, and 3 per cent used cartons (Table 12). The percentage of producers selling eggs in cases increased directly with the size of flock. The proportions using cases ranged from 25 per cent of the producers owning flocks of 100 or more layers to less than 2 per cent of the producers having flocks of fewer than 25 hens and pullets.

---

[4] The term "current receipt" refers to eggs that are not graded.

TABLE 12. Distribution of Egg Producers According to Method of Packing Eggs for Market, by Size of Flock, Louisiana, 1947

How Packed for Market	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Cases	1.4	2.8	7.0	25.1	5.5
Cartons	4.2	2.8	.0	7.1	2.8
Buckets	5.6	9.9	16.3	14.3	11.0
Boxes	11.1	5.7	9.3	3.5	7.9
Paper sacks	48.6	25.5	16.3	3.5	26.2
Other	27.7	52.5	51.1	43.0	45.7
Not ascertained	1.4	.8	.0	3.5	.9
TOTAL	100.0	100.0	100.0	100.0	100.0

Knowledge and Source of Market Information

Normally the marketing of eggs at the farm level in Louisiana is in such a disorganized manner that relatively few farmers have adequate information on the prevailing egg prices and the condition of the market when they need it. A smaller number avail themselves of authentic sources of egg marketing information during the marketing season.

Twenty-five per cent of producers stated that they always know the local market price of eggs before taking them to market, 42 per cent never know the market price, and 33 per cent reported that only sometimes do they know the current price before the date of sale (Table 13). Knowledge of market prices appears to vary directly with size of flock, that is, the larger the flock owned, the greater the proportion of producers who reported knowing the market price.

TABLE 13. Distribution of Egg Producers According to Knowledge of Local Price Before Eggs Are Sold, by Size of Flock, Louisiana, 1947

Knowledge of local price	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Always	22.2	21.3	31.4	33.2	25.1
Never	50.0	41.8	40.7	22.1	41.9
Sometimes	26.4	36.9	27.9	44.7	32.7
Not ascertained	1.4	.0	.0	.0	.3
TOTAL	100.0	100.0	100.0	100.0	100.0

Less than 25 per cent of flock owners reported receiving reliable market news regularly, and over 65 per cent received no egg market information whatsoever. There appears to be no significant differences in sources of market news used by producers owning different sizes of flocks.

FLOCK MANAGEMENT AND EGG PRODUCTION FACILITIES

Louisiana egg producers were asked to furnish information concerning management and production practices which are associated with the marketing of good quality eggs. The information was gathered on such items as (1) housing facilities and equipment, (2) management practices followed, and (3) care of eggs prior to placing them on the market.

In Table 14 data are presented with respect to the proportion of producers following various recommended practices. An average of 95 per cent of all flock owners reported using suitable nesting material, 84 per cent provided one or more nests for six layers, nearly all, or 97 per cent, allowed eggs to cool before packing them. Practically all producers allow layers free range every day of the year. Less than one per cent reported confining flocks especially in bad weather. Except for three of the practices, the proportion of producers following each recommendation is associated directly with size of flock. It may be expected that producers owning larger flocks would follow more of the recommended production practices and have better housing and equipment since they are likely to attach more importance to the poultry enterprise.

On the basis that many of the recommended practices are being followed by a relatively small portion of the producers, it is indicated that many Louisiana flock owners are not producing high quality eggs.

TABLE 14. Percentage of Egg Producers Providing Certain Recommended Production Facilities and Practices, by Size of Flock, Louisiana, 1947

Facilities and Practices	*Size of Flock*				*All Flocks*
	Under 25	*25-49*	*50-99*	*100 & Over*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
1. Housing and Equipment					
a. Use laying house	22.2	36.9	40.7	43.9	35.5
b. Use dropping boards or pits	2.8	4.3	8.1	15.6	6.1
c. Provide 1 or more nests for 6 layers	88.9	83.7	77.9	70.2	83.5
2. Management Practices					
a. Confine flocks	.0	.7	.0	4.2	.6
b. Feed mash 11-12 months	12.5	13.5	8.2	33.0	13.8
c. Use suitable nesting material*	88.9	96.5	95.3	98.5	94.5
3. Care of Eggs Before Selling					
a. Gather eggs 2 or more times daily	11.2	7.8	8.1	15.6	9.8
b. Use wire basket for gathering	.0	.0	2.3	.2	1.2
c. Allow eggs to cool before packing	94.5	97.9	98.8	93.9	97.0
d. Clean eggs with steel wool, emory cloth or sandpaper	1.4	.7	3.5	5.5	2.1
e. Hold eggs in cool place	32.0	52.5	41.9	43.9	44.3

*Straw or hay, cottonseed or hulls, shavings.

TABLE 15. Proportion of Local Eggs Sold by First Buyer, by Type of Outlet, Louisiana, 1947

Type of First Buyer	*Proportion of Local Eggs Sold to Various Outlets*								*Total Sales*
	Consumers	*Hucksters*	*Retail stores*	*Central wholesalers*	*Institutions*	*Local produce dealers*	*Farm Co-ops*	*Chain grocers*	
	Per Cent	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*	*Per Cent*
Country and city retail stores	67.6	17.6	2.8	11.7	.3	.0	.0	.0	100.0
Chain stores	100.0	.0	.0	.0	.0	.0	.0	.0	100.0
Local produce dealers	4.4	.0	28.9	8.8	27.6	2.7	.0	27.6	100.0
Rolling stores	28.9	48.0	.0	20.5	2.6	.0	.0	.0	100.0
General stores	53.3	20.5	.0	26.2	.0	.0	.0	.0	100.0
Hucksters	.0	.0	.0	.0	.0	.0	100.0	.0	100.0
Not ascertained	100.0	.0	.0	.0	.0	.0	.0	.0	100.0
All buyers	25.8	7.9	6.4	48.3	5.4	.5	.5	5.2	100.0

DISPOSITION OF EGGS BY FIRST BUYERS

The data assembled from first buyers of local eggs indicate that these dealers sold over 48 per cent of their eggs to central wholesalers and 26 per cent to local consumers. The remainder, or 26 per cent of the eggs, was distributed to hucksters, retail stores, institutions, local produce dealers, farm cooperatives, and chain stores. By and large, the eggs bought by country and city retail stores, chain stores and rolling stores were resold to local consumers (Table 15).

The resale of local eggs by first buyers and sale by producers directly to consumers and institutions amounted to about 56 per cent of the local eggs marketed. This indicates that more than half of the local egg marketings pass through not more than one agency before reaching the final consumer.

SUMMARY AND CONCLUSIONS

1. The average size of flock owned by Louisiana egg producers as of January 1, 1948, was 46 hens and pullets. Forty-three per cent of the flocks ranged in size from 25 to 49 birds and 22 per cent had fewer than 25 hens and pullets. Fifty-two per cent contained no pullets.
2. Retail stores were used as primary markets for eggs by a majority of producers irrespective of size of flock. Many small flock owners sold eggs to chain and rolling stores while the eggs from large flocks were taken by institutions and hatcheries.
3. Thirty-six per cent of the yearly egg supply occurred during March, April and May. The production peak of 13 per cent was in March and the lowest production, 6 per cent, was in October. Seasonal fluctuation in egg supply was greater among smaller than among larger flocks.
4. Based on this study, 62 per cent of the eggs produced in Louisiana are sold, 36 per cent are used in the home, and 2 per cent are hatched. Seasonal marketings follow closely the pattern of seasonal production.
5. Louisiana producers reported receiving an average price of 47 cents a dozen for eggs during 1948, ranging from 37 cents in March to 75 cents in December. The highest price was received from hatcheries at an average of 58 cents a dozen.
6. Much of the difficulty experienced in marketing eggs during the high production spring months was attributed to inadequate marketing facilities.
7. To market their eggs during 1947 producers reported traveling an

average distance of 5.7 miles. Distance to market appeared to have little effect on frequency of marketing eggs.

8. Over 57 per cent of producers sold eggs once a week, 24 per cent twice weekly, and about 3 per cent marketed them daily throughout the year.
9. Only 1 per cent of producers reported selling eggs on a graded basis. No more than 15 per cent made any attempt to separate eggs according to color at the first buyer level and these were mostly among the larger flock owners.
10. Relatively few producers knew the price of eggs before delivering them to market.
11. In general, the recommended production and marketing practices were followed by a relatively small proportion of the producers.
12. First buyers of eggs sold 48 per cent of them to central wholesalers and 26 per cent to local consumers. The remainder was distributed among other outlets.
13. Unsatisfactory seasonal fluctuation of egg prices to producers may be corrected somewhat by the employment of production practices which will distribute production more evenly throughout the year.

Few egg producers have access to efficient, local, cash markets. This inadequacy could be alleviated somewhat by the establishment of better assembly methods and more efficient and suitable marketing facilities. A marketing system is needed which will consolidate small volumes, increase rapidity of egg movement, and decrease the risk involved in handling eggs in small quantities. Marketing facilities and egg production are closely related and each is greatly influenced by the other.

Other constructive steps toward increased returns to Louisiana egg producers include improvement in the grade of eggs sold and payment on the basis of difference in quality. The paying of uniform prices for all grades offers no incentive to farmers to produce eggs of high quality. Buying eggs from farmers on a graded basis would encourage the production of better quality eggs and also offer some reward for better care in handling of eggs at the place of production.

73b

2nd ed.

LOUISIANA BULLETIN NO. 448 OCTOBER, 1950

FORTY-TWO YEARS OF SUGARCANE DISEASE RESEARCH AT THE LOUISIANA AGRICULTURAL EXPERIMENT STATION

●

A Report of Pathological and Botanical Investigations as They Have Affected the Louisiana Sugar Industry During the Period 1908-1950

By

C. W. EDGERTON

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

Forty-Two Years of Sugarcane Disease Research at the Louisiana Agricultural Experiment Station

A Report of Pathological and Botanical Investigations as They Have Affected the Louisiana Sugar Industry During the Period 1908-1950

C. W. EDGERTON

Introduction

At this time when the writer of this report is retiring after 42 years of service from active participation and from any official connection with the sugar industry, it seems appropriate to discuss the role played by the Department of Botany, Bacteriology, and Plant Pathology of Louisiana State University and the Louisiana Agricultural Experiment Station in the development of the sugar industry, the activities in which the department has been interested during these many years, and to list some of the results obtained by members of the department. No attempt will be made to list all of the interesting and important investigations carried on by other departments of the University or of other agencies working on sugar problems in Louisiana. Consequently, this report will include mainly the results obtained from investigations carried on by the Department of Botany, Bacteriology, and Plant Pathology and other investigations only as they have had a bearing on the pathological and botanical work with sugarcane. There will also be included a discussion of the investigations which are still unfinished and of other problems which in the opinion of the writer should be investigated if the present level of sugar production is to be maintained.

This has been a very eventful period in the history of the Louisiana sugar industry, including a series of years in which the yearly production of sugar gradually decreased, a period of depression caused by crop failures between 1924 and 1927, and then a series of years in which the production gradually increased, reaching another peak in 1938. The trend since 1938 is still not clear, but it is believed if something unforeseen does not happen, that, backed by the experience of the past and with the great amount of information gained by the research investigations, the high production of sugar can be maintained and perhaps increased.

Diseases have been considered to be the important factors in causing the low yields and crop failures, and consequently plant pathologists and botanists have taken a leading part in the investigations carried on with sugarcane. As nothing had been published about the diseases of sugarcane in Louisiana at the beginning of the period covered by this report, the plant pathologists had to start from scratch. Practically all of the information which is now available in regard to the diseases of sugarcane in Louisiana has been secured in this period. Much information has been obtained but still there is much more to be done. It is believed that a record at this time of the investigations which have been carried on and a discussion of the results will be valuable as a base for the "take-off" for those who are to follow.

It is hoped that this report will be of interest, not only to the technologists, but to all who are interested in sugarcane and the sugar industry in Louisiana.

Those to Whom Credit Is Due

During the period covered by this report, various members of the Experiment Station and Teaching Staffs in the Department of Botany, Bacteriology and Plant Pathology, and many graduate students have been interested in sugar problems. The progress which has been made is due to the combined work of all. The following have either carried on research projects or have assisted in the investigations.

Staff Members

H. R. Fulton
E. C. Tims
E. V. Abbott
L. H. Person
S. J. P. Chilton
R. T. Gibbens
Wm. J. Luke
E. R. Stamper
C. W. Edgerton
I. L. Forbes
T. C. Ryker
H. H. Flor
L. H. Flint
W. N. Christopher
P. H. Dunckelman
C. C. Moreland
P. J. Mills
C. F. Moreland
C. A. Brown
C. S. McCleskey
R. E. Atkinson
J. Dufrenoy

Graduate Students

F. J. LeBeau
W. E. Cooper
L. W. Faville
Ruth P. Phillips
R. Y. Nesom
M. L. Shaffer
Q. L. Holdeman
E. S. Hagood
C. S. Loh
Mrs. W. W. Hattox
F. Carvajal
R. J. Steib
L. E. Cowart
J. Guiscafre-Arrillaga

Fluctuations in Yield

In most countries where sugarcane has been grown on a commercial scale for a considerable period, history shows that fluctuations in the amount of sugar produced have occurred from time to time. These fluctuations have been of two kinds. First, there have been the variations from year to year, increases or decreases from the average due to temporary local conditions, fluctuations more or less similar to those occurring with other crops; second, there have been those which have extended over several or many years. The latter have usually been characterized by periods of rather long duration during which the production of sugar decreased rather constantly from year to year, or by periods during which production gradually or rapidly increased. Prosperity has usually accompanied the years with increasing production, while business stagnation, depressions and financial crises have frequently followed in the wake of low production.

Many factors are found to be concerned when an attempt is made to determine the cause of these fluctuations. Some of them are man-made, or at least influenced to a greater or lesser degree by man or man-made institutions, such as governments, sugar organizations, and research stations. Here may be classed such factors as wars, legislative acts in regard to tariffs, bounties and the like, inventions of new or improved machinery, and the general adoption of new methods of production based on information obtained by scientific research. Then, there are the so-called natural factors. Here, among others, should be included weather, climate, soil changes resulting from cultivation, and the attack of insect pests and diseases. Low yields caused by one or more of these natural factors have occurred at various times in a number of the important sugar-producing countries and in most cases, they have been very serious. However, the industry has usually survived and recovered and the results obtained by following programs based on scientific studies of the problems concerned have been remarkable and are landmarks in the history of the development of the sugar industry.

In the past, the crop failures which continued over a period of years were in most cases due to severe disease epidemics or epiphytotics, though in a few cases other factors, such as the attack of certain insect pests, were important, or, at least, contributed. Disease epidemics are much more apt to occur with sugarcane than with many other cultivated crops. Among the many reasons which might be listed to account for this, three seem particularly important. First, sugarcane, at least in the tropics, is in an active stage of growth during the entire twelve months of the year. This is very favorable for the dissemination and rapid increase of pathogenic organisms which may be present. Second, sugarcane thrives best where the rainfall, humidity and temperature are high. Such conditions also favor the disease organisms. Third, sugarcane is propagated vegetatively. All plants of a particular variety are genetically identical. This means that all plants will be equally resistant or susceptible to a particular parasite. If susceptible to a newly introduced parasite, or to a new strain of an old one, or to one which has been permitted to increase abnormally, all plants of the variety will be attacked and the whole crop may be seriously injured. This, unquestionably, is the most important of the three reasons.

It is interesting and instructive to trace the history of the sugar industry in a region like Louisiana, to determine the extent of the fluctuations in production from time to time and to find out, if possible, the cause or causes of declining yields in certain periods. It is also important to find out what measures were taken to bring the industry out of depressions caused by such natural factors as the attack of certain cane diseases. It will be found that history has repeated itself to a certain extent. In general, the opinions of growers during one depression have been similar to those expressed at earlier periods and the recovery measures suggested and tried at different times have had a great similarity. It will be found that the recovery measures which were successful were usually based on an extensive study of the industry and of the cane plant and its adaptation to existing conditions.

Sugarcane was first introduced into Louisiana by the Jesuit missionaries in 1751, though no extensive plantings were made for some years later. The sugar industry itself did not really have its beginning until after De Bore, in 1794, demonstrated that sugar could be made successfully from the sugarcane plant in Louisiana. After that event, the sugar industry, which of course includes the growing of cane and the manufacture of sugar from the cane juice, developed fairly rapidly. The sugar industry, then, has been in existence in Louisiana for nearly 160 years, a time sufficiently long for it to have felt the impact at one time or another of most of the factors which influence sugar production. It can be expected therefore that a study of the history of the industry will show periods of declining yields, periods of depression, and periods during which production was increasing. A knowledge of what happened in these different periods will bring out the importance of the various factors affecting cane growth and the production of sugar, and particularly of the natural factors associated with disease epidemics. This knowledge will also show the relation of scientific investigations to the problems of production and disease control and will emphasize the necessity of continuing such work.

The fluctuations in yield and the depressions in the sugar industry that have occurred in Louisiana should probably be considered from two viewpoints. There are, first, the actual yearly variations in the total production of sugar in the State and, second, the average variations in the production of cane per acre. In the following discussion, these variations will be brought out by graphs accompanied by statements regarding the factors which are believed to have influenced sugar production.

The variations in the total yearly production of sugar in the State since 1860 are shown graphically in Figure 1. The graph shows two periods in which yields declined severely. One was at the time of the Civil War and is readily explained. The other began in about 1905 and reached its low point in 1926. There are also shown two periods in which production increased rapidly. One of these began in about 1877 and reached its peak in 1904, and the other started in 1927 and reached its peak in 1938. Within two of these periods, there were shorter periods in which production seemed to level off for a time. As shown in the graph, there were several years between 1914 and 1920 in which production seemed to be stationary. This was apparently due to high prices and increased demand for sugar during World War I. Even during these years, production did not rise towards the peak which had been reached in 1904. Again during the recovery period beginning in 1927 when the curve of production was rising, there was a short period between 1929 and 1933 when the production leveled off. During this period, the P.O.J. canes, which were then being grown,

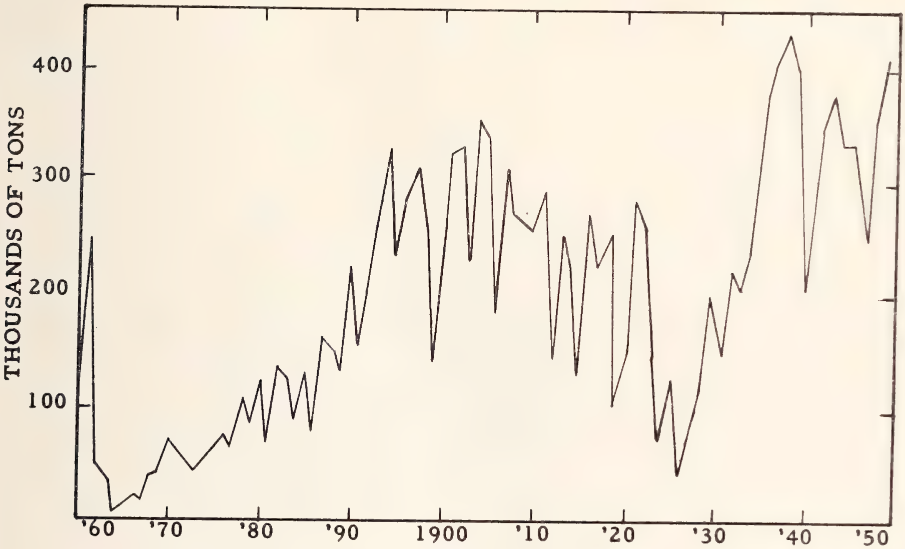


Fig. 1.—The Annual Production of Sugar in Louisiana from 1860 to 1949.

were apparently producing at their peak. During these few years, the production of sugar in the State was at about the 1914 to 1920 level. With the general planting of the Co. and the C.P. canes, production again rose rapidly to the 1938 and 1939 peak.

In considering the prosperity of the sugar industry and the occurrences of depressions and recovery periods, it would seem that information on the average yield of cane per acre is as important as is information on the total production of sugar. A graph showing the production of cane per acre for the period between 1890 and 1950 is presented in Figure 2.

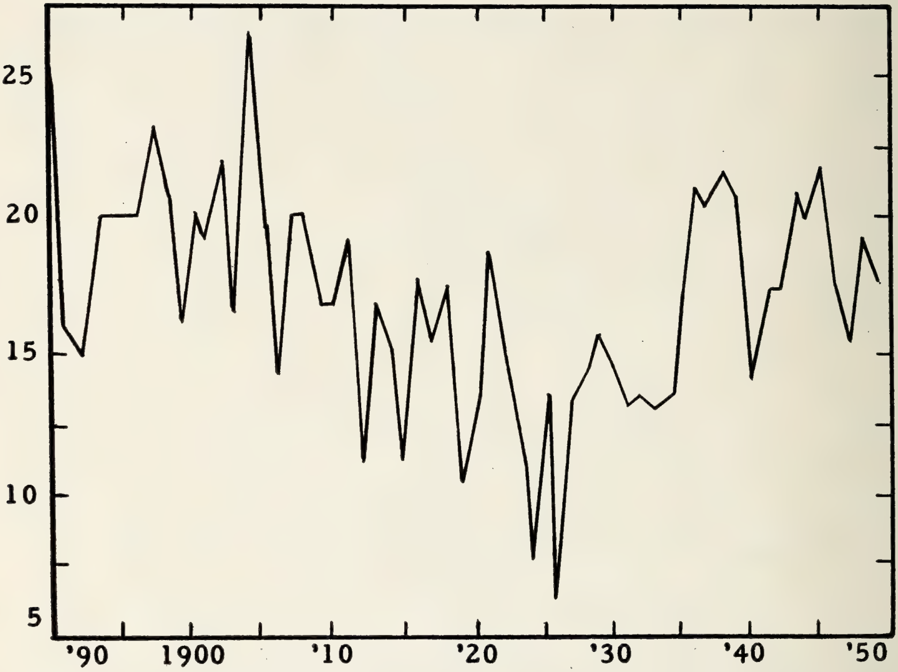


Fig. 2.—The Annual Yield of Cane per Acre in Tons, Louisiana, 1890 to 1949.

There is a remarkable similarity in the curves representing total production and production of cane per acre. In Figure 2, the curve showing the production per acre rises to a peak in 1904, slowly declines to about 1914, levels off to about 1920, and then drops rapidly to the low point in 1926. In the recovery period that followed, beginning in 1927, the curve gradually rises to about 1929, levels off to about 1934, and then again rises to the 1938 and 1939 peak. In considering production in relation to the prosperity of the sugar industry, it may be that the production of cane and of sugar per acre is more important than is the total production.

Since 1938 and 1939, the total production and also the production of cane per acre have both been below the peak level.

The Industry and Pathology Research

It is generally recognized at the present time that the prosperity, or even the existence, of such an industry as the sugar industry depends upon technical knowledge obtained by extensive research along various lines. For centuries, the sugar industry merely existed. The growers in early time by trial and error or by unconscious selection used those canes which they found in their gardens or fields which seemed to do the best under their conditions. Much credit, however, is due these early growers. Starting with some prehistoric plant which apparently does not even exist at the present time, they were able, by unconscious selection through the centuries, to obtain such excellent, high-sucrose canes as the Bourbon, Cheribon, and other similar ones. As the industry of today has been built on these canes, it is much indebted to these early growers.

As the demand for sugar increased, greater acreages of cane were planted and the industry expanded into new lands. As a result, problems developed which were not solved by the slow, unconscious method of selecting satisfactory canes. Finally when the industry felt the impact of such diseases as the sereh in Java, the so-called rind disease in the West Indies, the red rot in India, and the root rot in many countries, something had to be done. This meant the establishment of Experiment Stations with men in charge who were sufficiently trained to investigate the various problems that were constantly arising.

In Louisiana, research on sugarcane problems may be said to have started with the establishment of a Sugar Experiment Station in 1885 with Dr. W. C. Stubbs in charge. After 1906, the research was slowly expanded to cover many lines of work. The great expansion in sugarcane investigations, however, has taken place in recent years following the failure of the industry in the 1924 to 1926 period. At the present time, the research with cane, which includes investigations in plant pathology, plant physiology, weed control, entomology, plant breeding, agronomy, soil technology, and agricultural engineering, is very extensive.

Research work in pathology began with the appointment of a pathologist in 1906 at the time when troubles in the fields were being reported by various planters. At that time, the industry was in a relatively prosperous condition. Most of the planters did not know anything about the diseases of cane and consequently the idea that diseases might become very important and eventually affect their way of life, never entered their minds. Also, to the Experiment Station officials, sugarcane was only one of the important crops of Louisiana, and without any specific demands from the growers, there was no particular reason for stressing sugarcane investigations at the expense of other crops. For a time, and more particularly up to the period between 1919 and 1924, the investigations carried on by the one or two members then on the Staff were not confined to cane but were also concerned with many other crops, especially cotton and vegetable crops. The pathologist at that time was working under conditions which to a scientist seem almost ideal. His time was practically his own, and the investigations which he carried on were of his own choosing. The investigations on sugarcane at that time were largely on red rot and root rot. This was not because there was any particular demand on the part of the industry but because the problems with these diseases seemed to be particularly interesting and important to the pathologist. As it turned out, these diseases eventually came to be recognized as among the more important diseases in Louisiana. During this early period, much basic information was obtained which later was very useful.

Since 1924 the work in the Department of Botany, Bacteriology and Plant Pathology of the University and of the Department of Plant Pathology of the Experiment Station, due to a strong demand by the industry and with more funds for equipment and personnel, has expanded and extensive investigations have been carried on with diseases of cane and their control, the physiology of the sugarcane plant, studies of the organisms causing cane diseases, the role of soil organisms in cane culture, and in more recent years with sugarcane breeding and weed control problems.

Progress and Results of Research

In the following pages, there are presented chronologically the more important results obtained by the Staff members of the Department of Botany, Bacteriology and Plant Pathology, along with various events in the history of the industry which have influenced, or have seemed of interest to, the pathological work. This is strictly a report of the pathological and botanical investigations; space does not permit inclusion of the results of various other lines of research. This presentation should give to those interested a picture of the industry as it developed down through the years and an idea of the nature of the investigations that were carried on from year to year to meet the constantly changing problems.

The numbers in parentheses refer to the items in the list of publications at the end of this bulletin.

1820. Introduction into Louisiana of the Louisiana Purple and Louisiana Striped varieties. Previous to this date, the industry had depended upon the Creole, a variety which was unsatisfactory under Louisiana conditions.

1830. Introduction of the vacuum pan.

1844. Introduction of multiple effects which had been developed by Norbert Rillieux.

1852. Introduction of centrifugals.

1856. A very poor crop, only 41,231 tons as compared to 123,303 in 1855 and 154,047 in 1857. Because of unfavorable winter and spring conditions, the cane rotted very severely. The planters thought that the Louisiana cane had deteriorated and they induced Congress to send some warships to the tropics in order to bring back seed for a new start. Two shiploads were brought back but the cane was placed in the holds of the vessels and heated so badly that it was dead before reaching Louisiana. However, with the return of normal seasons, the old cane came back and again produced satisfactory crops.

1862-1865. Civil war period. The industry was temporarily destroyed.

1872. After a series of poor years, Mr. La Pice was sent to Asia to bring back new cane. The cane he brought back was grown to a limited extent for a number of years. It was known in Louisiana as the La Pice cane but seems to have been the Crystalina, a cane that at the time was being grown very extensively in the tropics.

1885. The Louisiana Sugar Experiment Station was established with Dr. W. C. Stubbs in charge. The early work of the Station on cultivation, fertilizers, and the introduction of new varieties and the chemical investigations in the sugar house, were responsible for the rapid development of the sugar industry in the years that followed.

1890. Establishment by Dr. Stubbs of the Audubon Sugar School for the training of students in practical and scientific phases of sugarcane culture and sugar manufacture.

1892. Erection of the first nine-roller, single-engine mill in the State.

1893. The D. 74 and D. 95 varieties were introduced from Demerara by Dr. Stubbs. Seed cane of these varieties was distributed to planters four years later. The D. 74 became one of the leading varieties in the State.

1894-1897. Bounty on sugar repealed in 1894. Tariff of 1.95 restored on sugar in 1897.

1897. Organization of Louisiana Sugar Producers' Association.

1899. A short crop. The coldest weather on record in Louisiana occurred in February, 1899.

1904. Largest crop on record up to that time, not surpassed until 1938.

1906. Sugarcane seed from the tropics was germinated in Louisiana by R. E. Blouin and A. E. Weller and seedlings were produced, the first time this had been done outside the tropics. During the following 11 years, 1842 seedlings were grown and tested.

1906. A short crop. Excepting the crop of 1899, which was affected by the cold, the 1906 crop was the first short crop since the introduction of the D. 74 variety.

1906-1908. Appointment of plant pathologists at the Louisiana Experiment Station to study the deterioration of cane that was believed to be occurring in the State. H. R. Fulton was appointed in 1906 and C. W. Edgerton in 1908.

1908. Fulton recognized and described the root rot of cane, listing the typical symptoms including the severe condition in which the stools could be easily pulled from the soil (1).

1908-1910. Red rot was found in State by Edgerton in 1908 (2). The rind disease and pineapple disease were reported two years later (3).

1911. Proof was presented that the red rot was reducing the sucrose content of cane in Louisiana (4).

1912. A short crop. This was influenced by the overflow of the river.

1913. The occurrence of the stem rot or Hawaiian "iliau" disease was reported by Edgerton (5). This disease caused some loss to the D. 95 variety.

1913. Underwood free sugar bill passed by Congress.

1914-1917. The importation of sugarcane seed into Louisiana was stopped owing to quarantine regulations of the Federal Horticultural Board. This, of course, stopped the production of new seedlings by the Experiment Station.

1914-1919. World war. Total production of sugar maintained by increased acreage in spite of declining yields.

1915. Another short crop.

1916-1920. Proof that the red rot was one of the important causes of poor stands of cane was presented by Edgerton and Moreland (6, 9).

1919. The mosaic disease was reported in the State by Edgerton (7, 8) and by Brandes (U. S. Dept. Agr. Dept. Bul. 829. 1919). At that time, the infection was largely confined to a few areas along the river.

1919. Cane breeding activities of the Division of Sugar Plant Investigations, U. S. Dept. of Agriculture, began at Canal Point, Florida.

1919-1920. Two years with short crops.

1921-1922. Two years with relatively large yields. In the years that followed, there was a consistent and rapid decline in sugar yields.

1922-1923. The Louisiana Experiment Station received 2500 seedlings and varieties from the U. S. Dept. of Agriculture. Among these were the varieties P.O.J. 36, P.O.J. 213, and P.O.J. 234. These canes were also received by the Sugar Station at Houma and by one of the large plantations. Testing of the new canes was pushed rapidly by the Experiment Station and by the Sugar Station at Houma.

1923-1926. Years with weather conditions extremely unfavorable for cane. The borer infestation was also very heavy.

1924. Practically a failure of the sugar crop. The worst drought on record occurred in Southern Louisiana with practically no rain during the whole summer and fall.

1924. More extensive investigations in Louisiana sugar production were started by the Louisiana Agricultural Experiment Station and the United States Department of Agriculture. A special appropriation was granted the Experiment Station by the State Legislature. Later, the United States Department of Agriculture received an increased appropriation for sugar work and the sugarcane breeding program was expanded at Canal Point, Florida.

1925. Proof was presented that the mosaic may appear and act differently even on the same variety. Selections were made of D. 74 and Purple canes that showed the disease in a very mild form. The evidence indicated that there was more than one strain of the virus involved (13).

1926-1927. Two years with very low production. The crop in 1926 was the smallest since 1864.

1926. Evidence was presented by McDonald of the U. S. Weather Bureau that weather conditions, particularly heavy rainfall and low temperature, during the winter months materially reduce cane yields (The Planter and Sugar Mfgr., May 29-July 17, 1926). This seems to be of particular importance when considered with the results obtained from the root rot investigations.

1927-1929. Evidence was submitted by Edgerton, Tims and Mills indicating that fungi of the genus Pythium were very important in the root rot problem in Louisiana (17, 21, 23).

1927-1930. Bacterial red stripe and mottle stripe diseases were reported from Louisiana and described by Edgerton and Christopher (20, 26).

1928-1931. General planting of the P.O.J. canes, the first step in the recovery from the depression.

1930. Presentation of proof by Flor that the fungus Pythium causes more injury during periods when the soil is cold and has a high moisture content, especially during the late winter and early spring (24, 25).

1930-1931. Severe epidemic of red rot in P.O.J. 213. It was necessary to abandon this variety and to substitute others. This variety occupied 35 percent of the sugarcane acreage in Louisiana in 1930.

1931. Proof presented by Tims and Edgerton that some varieties of cane recover at least from certain types of mosaic. This seemed to explain why certain varieties such as Co. 281 and P.O.J. 213 were at that time relatively free from mosaic (28).

1931. Studies on sugarcane roots by Ryker and Edgerton demonstrated the importance of protecting the roots by good soil preparation and shallow cultivation. County agents pushed recommendations made by the Experiment Station (27).

1931-1933. Two Coimbatore canes, Co. 281 and Co. 290, were released for general planting throughout the sugar belt. On account of the resistance of these canes at the time to red rot, stubble deterioration, and mosaic, they largely replaced the P.O.J. varieties. The general use of these canes constituted the second step in the recovery of the sugar industry in Louisiana.

1932. Proof was presented that there is more than one strain of mosaic attacking cane in Louisiana. A strain, apparently new to the State, attacked Co. 281 and some other varieties and rapidly spread over the sugar belt. Co. 281, which up to this time had remained practically free of mosaic, very quickly became one of the most susceptible varieties (29, 33).

1932. It was shown by Tims and Edgerton that all cultures of the red rot fungus do not show the same pathogenicity to different sugarcane varieties. The evidence, however, did not indicate that there were distinct, physiologic strains (30).

1932. An Actinomycete antagonistic to the root-rot Pythium was reported by Tims (31).

1933-1934. The Canal Point seedlings C.P. 28/11, C.P. 28/19, and C.P. 29/320 were released for general planting. All of these were very valuable for a number of years. The first two, however, gradually failed and were practically abandoned. On the other hand, the C.P. 29/320 remained a satisfactory cane and as late as 1950 was planted on a sizable acreage. The use of the Canal Point seedlings constituted the third step in the recovery of the sugar industry in Louisiana.

1933-1938. Data indicating that there are at least two distinct strains of the red rot fungus attacking varieties differently, were presented by Abbott of the Division of Sugar Plant Investigations, U. S. Department of Agriculture. He believed that the severe epidemic in P.O.J. 213 was due to the build-up of a particular strain (Phytopathology 23:557-559. 1933; and U. S. Dept. Agr. Tech. Bul. 641. 1938).

1934-1939. Based on extensive investigations, Summers of the Division of Sugar Plant Investigations reported the occurrence in the State of at least 10 distinct and recognizable strains of the mosaic virus (Phytopathology 24:1040-1042, 1934; and Proc. 6th Cong., Internal. Soc. Sugar Cane Technol., pp. 564-565. 1939.).

1934-1939. Attention was directed by Edgerton, Tims and Mills to stubble deterioration. Both root rot and red rot seemed to be involved. As poor-stubbling canes were considered dangerous, it was recommended that such canes not be released for planting (32, 41).

1934-1937. Jones-Costigan act was passed by the National Congress. This set up a quota system to regulate the amount of cane that could be grown and also provided for benefit payments to the growers. This was the beginning of the attempt by the National Government to regulate sugar production.

1937. The occurrence of chlorotic streak in the State was reported by Abbott of the Division of Sugar Plant Investigations (The Sugar Bulletin 16 (17):3-4. 1938; and also Phytopathology 28:855-857. 1938).

1937-1939. Investigations reported by Atkinson and Edgerton showed that spores of the red rot fungus migrate through the large ducts in the fibro-vascular bundles. In varieties such as Co. 281 with open ducts, the spores are able to migrate through several internodes, while with varieties such as C. P. 29/116 with cross walls in the ducts, the spores usually remain confined to a single internode (38, 40).

1938. The 6th Congress of the International Society of Sugar Cane Technologists held in Louisiana. Delegates from most of the sugar-producing countries were present.

1938-1939. Investigations by Shaffer demonstrated that it was possible by roguing to keep fields of the variety Co. 290 comparatively free of mosaic. As a result, this valuable variety was saved. Results with Co. 281 were not as successful (47, 48).

1938. Largest yield of sugar in Louisiana on record. This provided the peak in the ascending curve beginning in 1927, based on production of sugar.

1938-1946. Extensive investigations were carried on by various members of the department on the hot water treatment of seed cane. At the request of the American Sugar Cane

League, extensive field tests were made in various parts of the sugar belt during a five-year period. The hot water treatment eliminated the chlorotic streak virus from the seed cane and also stimulated the germination of the buds. Increased stands and increased yields up to three to four tons per acre were obtained (49, 52, 58, 64, 67, 70, 72).

1941-1948. Results of investigations indicating that losses from the cane borer could be reduced by dusting with cryolite and other poisons were presented by the Department of Entomology, Louisiana Agricultural Experiment Station, and by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. As the red rot fungus enters the cane stalk through borer channels, the control of the borer will also reduce the loss from red rot.

1942-1944. The perfect stage of the red rot fungus was found and described by Carvajal and Edgerton. The name of the fungus became *Physalospora tucumanensis* Speg. (62).

1943. As shown by Forbes, the mosaic virus disappears from plants that recover from mosaic (59).

1943-1944. As reported by Edgerton and Carvajal, infection by the red rot fungus can take place by infection threads from appressoria penetrating the uninjured epidermis (66).

1944. Resistance to red rot was shown to be closely associated with the formation of the red zone around the infected area. The mycelium of the red rot fungus does not penetrate this zone readily. Resistance to the disease depends on how rapidly the red zone forms. In resistant varieties, this zone forms very quickly (66).

1944-1947. A special appropriation by the State Legislature was made to the Louisiana Agricultural Experiment Station for the eradication of the alligator weed which was very troublesome in Louisiana sugar fields. Investigations by Brown, Carter, Holdeman and others, and by Arceneaux of the Division of Sugar Plant Investigations, U. S. Department of Agriculture, showed that this plant could be easily eradicated by spraying or dusting with 2,4-D. On most plantations, the weed was quickly brought under control (71, 73, 74, 75, 87, 88).

1945. It was shown by Forbes that the mosaic virus will move from a young plant through the old seed-piece in the ground to another plant (68).

1947. As shown by Steib and Chilton, infection by red rot in planted stalks takes place mainly through the bud scales and the old leaf scars. Most cane stalks are infected when planted, the red rot mycelium being in an inactive condition (77).

1947-1950. Based on investigations by Chilton, Stamper, and Ryker, considerable progress has been made towards the control of Johnson grass (89, 90, 91, 92, 96).

1947. As determined by Steib, Johnson grass seed produced in Louisiana germinates readily under the right conditions (84).

1947-1950. From investigations on seed-piece decays, Chilton found that a species of Phytophthora is one of the important organisms responsible for the rotting of seed cane in the soil during the winter months.

1947-1950. In a preliminary survey, Cooper found that certain Actinomycetes which are abundant in the soil are antibiotic to Pythium, one of the important root rot organisms (83, 95).

1948-1950. In order to increase the number of sugarcane seedlings, an extensive breeding project to supplement the work of the U. S. Department of Agriculture was started under the supervision of Chilton. From 70,000 to 80,000 seedlings have already been produced.

1949. The investigations of Phillips and Chilton indicate that there is an enormous amount of viable Johnson grass seed produced in sugarcane fields. This has emphasized the necessity of having satisfactory control measures for Johnson grass seedlings (93).

Discussion

Looking back over a long period of years during which the sugar industry, in its ups and downs, has been watched closely and during which intensive investigations have been carried on with problems which at the time seemed important, certain conclusions have been reached and certain ideas and theories have evolved which may be worthy of consideration.

The investigations in the department have mostly been concerned with disease problems, though in recent years considerable attention has been directed towards weed control and in obtaining information on the very important problems concerning the role played by organisms in the soil on soil fertility and on their relation to plant growth. The diseases which have received the most attention are the red rot, root rot and mosaic. These are considered to be the major cane diseases in Louisiana at the present time. The red rot has been studied for more than 40 years, and probably there is more basic information available concerning it than for any other cane disease caused by a parasitic organism. Much information has been obtained in regard to the life cycle of the organism, methods of infection, environmental conditions favoring the disease, and factors related to resistance. Varieties known to be very susceptible have been abandoned and new seedlings are not released unless they show considerable resistance. As to the root rot, much valuable information has been obtained in regard to varietal resistance and the relation of the environmental factors favoring it. It is known that losses from root rot can be materially reduced by good drainage and by cultivation which does not injure the roots of the cane plants. There is evidence that severe losses are still occurring due to destruction of roots from cultivation. Much information has been obtained in regard to mosaic. This disease, however, has temporarily become of minor importance. With the exception of Co. 290, the susceptible varieties have been abandoned and new seedlings showing susceptibility are not released. Even if new strains of the virus should appear, it is believed that the susceptible varieties could be discarded before a serious situation developed. The minor cane diseases such as the bacterial stripe diseases, the Helminthosporium and Cercospora leaf spots, the pokkah boeng, the chlorotic streak and a few others have received considerable attention and their places in the general disease problem are fairly well understood.

As to the work of the future, there is still much to be done and there are still many problems awaiting solution. It may be useful at this time to focus attention on some of these problems and to present certain ideas and theories which have come to mind as a result of the many years of research. Some of the theories and ideas may be controversial, and so it should be said, using the words of the radio broadcaster that "the opinions are those of the speaker and not necessarily those of the Station." Nevertheless, it may be useful to keep them in mind as the problems of the industry, both old and new, are investigated in future years. Technologists, as well as others, are prone to accept as facts, ideas and theories which have been presented to explain some difficult problem but which are not based on reliable data. Progress may come, then, not only by the acquisition of new information but also by a willingness to question, and to discard if necessary, old accepted ideas and theories which are untenable.

Cause of Depressions. Depressions have occurred in the sugar industry at one time or another in practically every sugar-producing country. During these depressions, the yields of cane usually decreased from year to year, finally reaching the critical point when the returns were not sufficient to pay the costs of production.

Satisfactory explanations of the cause or causes of these depressions have not been given. As disease epidemics have in most cases been assumed to have been responsible, pathologists have had a leading role in the intensive investigations which have been responsible for the recovery of the industry. At one time or another, various diseases have been held responsible for the poor growth of the cane during the depression periods. Among others may be mentioned the sereh in Java, the gummosis in Brazil, the rind disease and the red rot in the British West Indies, the red rot, root rot and mosaic in Argentina and Louisiana. Looking back, it is not possible to accept in toto the explanations which were current at the time of the various depressions or those which were presented later.

The depression in Java was the first one that was studied intensively by technologists. The poor growth of cane was said to have been due to the attack of a disease which was given the name sereh. This disease was often spoken of as the great mystery of the sugar industry. At the beginning of the depression, the sereh apparently included most of the diseases of cane which were present in Java. The early pathologists gradually separated from it such diseases as the red rot, the pineapple disease, the chlorotic streak, the leaf scald and others. When these were recognized as distinct, there was not much left. At the present time, it is doubtful whether there is anyone who would be willing to identify the sereh in the field. Consequently, the sereh is still the great mystery of the sugar industry.

The gummosis was first described from Brazil. That this was the cause of the trouble in Brazil from 1860 to 1870, has very generally been accepted by sugarcane technologists. However, as late as 1938, Bitancourt stated that "the identification of gummosis in Brazil is based on the symptoms of the disease, no proof having yet been given of its actually being caused by *Bacterium vascularum* (Cobb) Grieg-Smith, agent of gummosis in other countries" (Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., p. 190. 1939).

The rind disease was said to have caused the failure of the Bourbon cane in the West Indies in the period between 1890 and 1900. The fungus causing this disease is now known to be a very weak parasite and so could not have been responsible for the crop failures.

The red rot is world-wide in distribution and the claim has frequently been made that it was involved in certain crop failures, particularly in India, British West Indies and Louisiana. The fungus causing it is definitely parasitic and under the right circumstances causes severe losses, but the evidence is not sufficient to indicate that, by itself, it could continually over a period of years cause crop failures or even declining yields.

The term root rot is one which has been used very loosely to explain almost any growth failure. Many organisms have at one time or another been involved, but the evidence now available is not sufficient to show that any one of them is capable of causing crop failures year after year. Rather, the evidence seems to indicate that root rot, as the term is now used, includes a complex of pathologic, physiologic and soil biologic factors, and it is still not possible to evaluate any one, either by itself or in the complex. It would seem that the statement made by Earle in 1920 that "there is probably no other plant disease of equal importance about which so little is really known and concerning which such erroneous ideas have long passed current in plant-disease literature" is still relatively true. To be sure, much valuable information has been obtained in regard to the organisms involved, the soil relations, and the adaptation and requirements of the sugarcane plant, but there still seem to be missing links. It is essential that the basic investigations be continued so that eventually some one may be able to evaluate all of the factors, including any new ones which may be recognized, and to put them together to form a true picture of the root rot problem.

It is not possible at the present time to explain satisfactorily the declining yields which occurred in Louisiana in the period between 1905 and 1920. Technologists have suggested that red rot and root rot may have been responsible for the trouble. These undoubtedly were important but how and why are not clear. The proper explanation of what happened during such periods would be of immense help to the technologists and to the industry of the future years.

Undoubtedly, the same factors which have been responsible for disease epidemics are also responsible for holding down the yields of cane in Louisiana. Yields of 60 tons per acre with Co. 290 and nearly as much with C. P. 29/320 have been obtained in the State. This shows the possibilities when all conditions are at the optimum. The average yields in the State, however, ordinarily vary from 19 to 21 tons. The spread between 20 tons and 60 tons is definitely too great. With more information in regard to root rot and other diseases, the activities of soil organisms, and physiology of the cane plant, it is not unreasonable to believe that average yields could be raised to 30 to 35 tons. It is, at least, a goal towards which the industry should strive.

Deterioration of Varieties. Cane varieties do not last indefinitely. Ordinarily, a variety will produce at its maximum for a few years and then the yields will begin to drop. Eventually, it is abandoned and other varieties are substituted. What is responsible for the deterioration of a variety is not clear. The plant physiologist is probably correct when he claims that a vegetatively-propagated variety will not by itself deteriorate. This means, then, that the factors responsible for the deterioration must be external. This means that certain organisms must become definitely specialized to that particular variety or that the soil conditions for some unexplained reason become less satisfactory for the growth of the plants. It is reasonable to believe that the same factors that have been responsible for the depressions during the past centuries are also involved in the deterioration of individual varieties. It, however, is still not clear why a particular variety should rather suddenly become sensitive to one or more of these factors.

In Louisiana, the sugar industry experienced the deterioration of the Louisiana Purple and D. 74 canes in the period between 1905 and 1920. Since the depression, it has taken in stride the failure of such valuable and important varieties as P.O.J. 213, Co. 281, and C. P. 28/19. At the present time, Co. 290 is not as dependable as formerly and even C. P. 34/120 seems to be developing weaknesses which eventually may be dangerous. Of the recent important canes, C. P. 29/320 seems to be an exception as it has held up over a considerable number of years.

From a practical standpoint, the investigations have shown the necessity of being able to recognize when a variety begins to slip and to have other varieties ready to take its place. For the industry to continue in a prosperous condition, the production and the testing of new varieties must continue until much more is known about the factors responsible for the decreasing yields.

Seed-cane Rots. In Louisiana, the seed cane which is planted in the fall remains in the soil in a more or less inactive condition until the temperature begins to rise in the late winter and early spring. During this period, the cane is attacked by soil organisms of various types and many of the buds are destroyed or severely injured. On an average, only about 15 to 25 percent of the buds produce shoots. To take care of this loss, usually about two or more running stalks are planted. Even with this amount of seed, especially when soil conditions are not satisfactory, poor stands are not uncommon.

For years it has been known that red rot will cause poor stands, and recently it has been found that another fungus, a species of Phytophthora, will under some conditions destroy the seed cane. Investigations are now under way to determine if seed cane rots can be reduced by treating the cane at planting time with fungicides and by a more careful planting procedure.

Antibiosis. Many organisms in the soil secrete complex substances, known as antibiotics, which are toxic to other organisms. Some of these antibiotics, such as penicillin and streptomycin, have almost revolutionized the practice of medicine in recent years. Information in regard to the substances secreted by most of the soil fungi and bacteria is still very deficient. These substances definitely enable many organisms to survive in the soil in competition with other organisms.

These antibiotic-producing organisms unquestionably have an effect on the soil flora and indirectly on soil fertility. While it may be assumed that some organisms which are desirable in the soil are eliminated, it has also been shown that certain pathogenic forms are also eliminated, or at least held in check, by these antibiotic organisms.

Some investigations have been under way in Louisiana on these antibiotic organisms. As early as 1932, it was shown that the growth of the root-rot Pythium was checked by a soil Actinomycete. Recently a preliminary survey was made of the Actinomycetes in the soil in the Sugar Belt. It was determined that many of them check the growth of Pythium. Such investigations should be continued and the scope expanded. The field is still unexplored and the possibilities are enormous.

Host-Parasite Relationships. For a better understanding of many of the diseases of cane, more basic information should be obtained in regard to the relations between host and parasite. A start has been made with the red rot and considerable information is now available in regard to how the fungus enters the host, how the fungus travels in the host tissues, and the reaction of the host cells. More information concerning host-parasite relationships should help the pathologist to work out better control measures and to make a start towards explaining the nature of resistance, probably the most complex but at the same time the most important problem in pathology. It is not unreasonable to hope that some of the questions regarding host-parasite relationships may be answered by using various radio-active substances as tracers.

Chemical Controls. During recent years, there has been great interest in the use of chemicals for controlling pests of various types, including insects, disease-producing organisms, and weeds. Investigations have been conducted on a large scale and unquestionably this work will continue to expand. The staff members of the Department of Botany, Bacteriology and Plant Pathology have been testing chemicals to control the various seed cane rots and to control weeds. The tests aimed at controlling Johnson grass have given such promising results that at the present time many growers are using chemicals to control this pest. Up to the present time, the investigations have been largely concerned with testing the chemicals that are being produced by various chemical companies. For the work to progress as it should, investigations should be started to determine how these chemicals affect the plants and the conditions under which they are active. The department recognizes the need of a trained physiologist and bio-chemist to carry on such work.

Many types of chemicals are presently being used. Some of these are merely contact poisons but others are hormone-like, growth-promoting substances. The hormones are extremely interesting, as they seem to act on the enzyme systems of the plants.

The study of hormones is one of the principal lines of work in the field of biology at the present time. The opportunities for obtaining interesting and valuable results are very great. Results with hormones may perhaps be speeded up by more extensive tests with radio-active tracers.

Before the work with chemicals proceeds too far, the technologists should determine what may be the effect of these substances on the soil. Little is known as to how these chemicals affect the soil or the soil flora. A microbiologist working on the soil flora and fauna might acquire information which would be of great value if troubles threaten in the future.

Threats of New Diseases and New Virulent Strains of Parasites. From a pathological standpoint, the sugar industry of Louisiana is still threatened from without and from within. There are a number of diseases in various parts of the world which have not as yet become established in Louisiana. Two of these, the smut in Argentina and Brazil and the leaf scald in Brazil, are relatively near. Others farther away include the downy mildew. Also in Queensland, pathologists are talking about a virus which checks growth of the cane and reduces the yield without producing visible symptoms on the plants. There are quarantines to keep such diseases out, but no quarantine is perfect and if a new disease should be introduced, it might cause considerable trouble until certain adjustments in regard to varieties and perhaps culture procedure could be made.

It is generally assumed at the present time that many lower organisms are not stable. New strains appear by mutation. It is also assumed that some of these new strains are more virulent than the old, parent strains, or are able to attack varieties which previously had appeared to be more or less resistant. Such new strains may become serious threats to the industry and may even make it necessary to discard very valuable varieties. These new strains are very confusing to the technologists but they must be recognized and studied.

Sugarcane Breeding Possibilities. The sugar industry of the world owes much to the early investigators in Java and India who found that it was possible to cross the Noble canes with the wild canes of the Pacific areas and to obtain varieties which were more vigorous and also more resistant or tolerant to some of the hazards which could not be eliminated by ordinary measures. In Louisiana, the recovery of the industry and its maintenance at the present level of production were made possible by the use of these hybrid canes, some of which were brought in from the Pacific areas and some of which were produced in this country. One of the major projects at the present time is the production of these new canes. Possibly 75,000 or more are being tested yearly in Louisiana.

The sugar industry, however, should recognize the limits of the cane breeding work. When two varieties are crossed, there is a recombination of the characters present in the parents. This has a certain similarity to the building of a new house with old materials. A wooden house may be torn down and the different pieces used to build a new house. These may be put together in a different way, but at the finish the new house is still a wooden structure. Again, if a wooden house and a brick house are torn down, a new house can be built of both brick and wood. After some experimentation and testing, a desirable combination of these two materials may be obtained. Beyond that, there is not much chance of improvement.

And so it is with sugarcane. When two varieties are crossed, the various factors of the two are recombined more or less by the law of chance. Most of the progeny are worthless because, except in a few, there is not a predominance of desirable characters. If, however, enough seedlings are grown, now and then, by the law of chance, one will be found that has a large portion of the desirable characters of each parent. After such seedlings are obtained, further improvement is slow. In other words, the production of better hybrids, provided the parents remain the same, seems to approach a limit. The experience in Louisiana has been about as would be expected. At first, the improvement was very rapid and in a very few years, a few very valuable canes such as C.P. 29/320 and C.P. 28/19 were secured. To improve on these from a production standpoint has not been easy. A few of the later canes such as C.P. 34/120 have in some ways been better, and some of the very recent canes seem promising. The number of canes, however, which have been released in recent years and have become important commercial canes has been relatively small. Of course, better canes, canes resistant to certain hazards, can and must be produced in the coming years.

Again, contrary to statements which have been made, there is no evidence to show that the present commercial canes from a production standpoint are better than were the old Noble canes such as D. 74 and Louisiana Purple in the period between 1890 and 1904. It may be admitted that statistics of that early period are not very reliable but they are probably accurate enough to show the situation at that time for comparison with that of the present time. As reported, yields of 27 tons per acre were obtained in 1890 and 26 tons in 1904. The nearest approach to this in recent years was 21.7 tons in 1938 and 21.96 tons in 1945. Of course, that is not the whole story. At the present time, D. 74 and Louisiana Purple are absolutely worthless and the new canes have the ability to make a satisfactory growth in spite of the various hazards.

Cane breeding at the present time seems to be very largely concerned with producing varieties that will produce satisfactorily in spite of the known and unknown hazards. There is still much to be accomplished. Canes which are relatively resistant to the various diseases and also resistant to any new strains of any of the pathogenic organisms which may appear, must continue to be produced. Also technologists must strive to produce canes which are adapted to certain areas, canes which are better adapted to mechanical harvesting, canes which shade the soil and check weed growth, and canes with low fiber provided that they are also resistant to the various diseases. Canes must continue to come off the assembly line and be available to take the place of those that are failing. There is no question but what the breeding work must continue and also be expanded if the present level of production is to be maintained and raised.

There is, however, another angle to the production problem which should never be forgotten. There is little probability in the immediate future of producing a super cane that will continue to produce maximum crops indefinitely with a minimum of effort on the part of the growers. For a time, at least, growers must depend on varieties similar to those now in cultivation. The evidence indicates that any of the varieties which are now being grown commercially are capable of producing maximum yields if the various hazards are eliminated. Yields of 50 to 60 tons per acre have been obtained with Co. 290 and C.P. 29/320 and it may be assumed that the other varieties are capable of doing as well. This being the case, it may be that from a production standpoint more progress can be made by more extensive investigations on the nature of the hazards and by putting into practice measures, based on information which is at present available, aimed at eliminating or at least reducing the losses from these hazards.

To raise the production level, then, requires the work and cooperation of two groups, the technologists to find out more about the requirements of the sugarcane plant and of the hazards of growing the crop, and the planters to use more effectively the information available to make conditions in the field the most favorable for growth of the plant.

Summary

This is a brief summary of the work of the Department of Botany, Bacteriology and Plant Pathology on sugarcane and sugarcane disease problems during a period of 42 years. During this time in Louisiana there was a long period of declining yields, a depression, and a period during which yields increased. Practically all of the information now available concerning sugarcane diseases has been acquired during this period. All of the diseases have been studied, but the three major diseases, red rot, root rot and mosiac, have received the most attention.

Other botanical problems which received attention include root development and root activities, the relation of the organisms in the soil to soil fertility and to parasitic organisms, production and testing of new cane seedlings, and weed control.

The problems which require intensive research in the immediate future are briefly discussed.

The More Important Publications of the Department of Botany, Bacteriology and Plant Pathology, Louisiana State University, on Sugarcane and Sugarcane Diseases, 1908-1950.

1. Fulton, H. R. The root disease of sugar cane. La. Bul. 100. 1908.
2. Edgerton, C. W. Colletotrichum falcatum in the United States. Science, n. s. 31:717-718. 1910.
3. ________________. Some sugar cane diseases. La. Bul. 120. 1910.
4. ________________. The red rot of sugar cane. La. Bul. 133. 1911.
5. ________________. The stem rot or Hawaiian "iliau" disease of sugar cane. Phytopathology 3:93-98. 1913.
6. ________________. Sugar cane diseases in Louisiana. La. Planter and Sugar Mfgr. 61:380-381. 1916.
7. ________________. Mottling disease or mosaic of sugar cane. La. Planter and Sugar Mfgr. 62:397. 1919.
8. ________________. Mosaic or mottling disease of sugar cane. L. S. U. Ext. Circ. 32. 1919.
9. ________________ and C. C. Moreland. Effect of fungi on the germination of sugar cane. La. Bul. 169. 1920.
10. ________________. A method of selecting L. 511 cane free of the mosaic disease for planting purposes. La. Bul. 176. 1920.
11. ________________. W. G. Taggart and E. C. Tims. The sugar cane disease situation in 1923 and 1924. La. Bul. 191. 1924.
12. ________________. The sugar cane disease situation in Louisiana. Reference Book of the Sugar Industry of the World 2:82-83. 1924.
13. ________________ and W. G. Taggart. Tolerance and resistance to the sugar cane mosaic. Jour. Agr. Research 29:501-506. 1924.
14. Abbott, E. V. A study of microbiological activities in some Louisiana soils. La. Bul. 194. 1926.
15. Edgerton, C. W., W. G. Taggart and E. C. Tims. The selection of seed cane. La. Bul. 195. 1926.
16. ________________. Storm damage to cane varieties. Planter and Sugar Mfgr. 77:208-210. 1926.

17. Tims, E. C., and P. J. Mills. Some fungi associated with the root disease of sugar cane in Louisiana. Reference Book of the Sugar Industry of the World. 5:33-37. 1927.
18. Edgerton, C. W., and E. C. Tims. Investigations on the sugar cane disease situation in 1925 and 1926. La. Bul. 197. 1927.
19. Stoneberg, Hugo F. The productiveness of corn as influenced by the mosaic disease. U. S. Dept. Agr., Tech. Bul. 10. 1927.
20. Edgerton, C. W., and W. N. Christopher. The red stripe disease of sugar cane. Planter and Sugar Mfgr. 79:63. 1927.
21. ——————. The fungus, Pythium, in relation to the root rot of sugar cane. Reference Book of the Sugar Industry of the World 6:39-40. 1928.
22. Flor, H. H. Germination of P.O.J. canes. Reference Book of the Sugar Industry of the World 7:30. 1929.
23. Edgerton, C. W., E. C. Tims, and P. J. Mills. Relation of species of Pythium to the root-rot disease of sugar cane. Phytopathology 19:549-564. 1929.
24. Flor, H. H. Relation of environmental factors to growth and pathogenicity of Pythium isolated from roots of sugar cane. Phytopathology 20:319-328. 1930.
25. ——————. Factors influencing the severity of the root rot troubles of sugar cane. La. Bul. 212. 1930.
26. Christopher, W. N., and C. W. Edgerton. Bacterial stripe diseases of sugarcane in Louisiana. Jour. Agr. Research 41:259-267. 1930.
27. Ryker, T. C., and C. W. Edgerton. Studies on sugar cane roots. La. Bul. 223. 1931.
28. Tims, E. C., and C. W. Edgerton. Behavior of mosaic in certain sugarcane varieties in Louisiana. Amer. Jour. Botany 18:649-657. 1931.
29. ————and————. Behavior of mosaic in certain sugar cane varieties in Louisiana. Phytopathology 22:27. 1932.
30. ————and————. The red-rot disease. Proc. 4th Cong., Internatl. Soc. Sugar Cane Technol. Bul. 26. 1932.
31. ——————. An Actinomycete antagonistic to a Pythium root parasite of sugar cane. Phytopathology 22:27. 1932.
32. Edgerton, C. W., E. C. Tims, and P. J. Mills. Stubble deterioration of sugarcane. La. Bul. 256. 1934.
33. Tims, E. C., P. J. Mills, and C. W. Edgerton. Studies on sugarcane mosaic in Louisiana. La. Bul. 263. 1935.
34. Edgerton, C. W., and E. C. Tims. Testing canes for disease resistance in Louisiana. La. Bul. 267:7-10. 1935. Also, Proc. 5th Cong., Internatl. Soc. Sugar Cane Technol., pp. 494-497. 1935.
35. Tims, E. C., P. J. Mills, and C. W. Edgerton. Disease resistance of commercial canes. La. Bul. 267:10-12. 1935.

36. Moreland, C. F. Leaf temperatures of sugar cane. Plant Physiology 12:989-995. 1937.
37. Edgerton, C. W., I. L. Forbes, and P. J. Mills. Losses caused by the mosaic and red rot diseases of sugar cane. La. Bul. 288:3-8. 1937.
38. Atkinson, R. E., and C. W. Edgerton. Possible migration of spores of red rot fungus in cane stalks. La. Bul. 288:8-10. 1937.
39. Forbes, I. L., P. J. Mills, and C. W. Edgerton. Immunity studies with sugar cane mosaic. La. Bul. 288:10-12. 1937.
40. Atkinson, R. E. On the nature of resistance of sugarcane to red rot. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 684-692. 1939.
41. Edgerton, C. W. Stubble deterioration. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 334-341. 1939.
42. Forbes, I. L. Immunity studies with sugarcane mosaic. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 566-572. 1939.
43. LeBeau, F. J. The relation of environmental factors and antagonistic organisms to root rot of sugarcane and corn. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 342-347. 1939.
44. Ryker, T. C. The Rhizoctonia disease of Bermuda grass, sugarcane, rice and other grasses in Louisiana. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 198-201. 1939.
45. Tims, E. C. Recent developments in sugarcane pathology. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 213-222. 1939.
46. ________________. Dwarf or multiple bud disease of sugarcane in Louisiana. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 467-471. 1939.
47. Shaffer, M. L. Seed selection and roguing in the practical control of mosaic disease of sugarcane in Louisiana. Proc. 6th Cong., Internatl. Soc. Sugar Cane Technol., pp. 554-563. 1939.
48. ________________. Seed selection and roguing in the practical control of mosaic disease of sugarcane in Louisiana. La. Bul. 308. 1939.
49. Edgerton, C. W., and I. L. Forbes. Hot water treatment of seed cane. The Sugar Bulletin 18 (18) :4-5. 1940.
50. ________________. The mosaic disease and Co. 281. The Sugar Bulletin 19 (10) :28. 1941.
51. McCleskey, C. S. The effectiveness of juice clarifiers in the removal of bacteria from cane juice in the sugar factory. The Sugar Bulletin 19 (13) :53. 1941.
52. Edgerton, C. W., et al. The hot water treatment of sugarcane. A report of progress. La. Bul. 336. 1942.

53. Forbes, I. L. Red rot and the deterioration of Co. 290 seed cane. The Sugar Bulletin 20 (11):86-87. 1942.
54. Luke, W. J., and C. W. Edgerton. The hot water treatment of cane seed. The Sugar Bulletin 20(18):148. 1942.
55. Dufrenoy, Jean. The occurrence of pyridoxin (vitamin B_6) in sugarcane tissues. Proc. La. Acad. Sci. 7:13-16. 1943.
56. Mills, P. J., and Jean Dufrenoy. Germination of the buds of sugarcane. Proc. La. Acad. Sci. 7:17-19. 1943.
57. Forbes, I. L., and P. J. Mills. Mosaic and red rot studies. The Sugar Bulletin 21 (18):138-140. 1943.
58. Dunckelman, P. H., and C. W. Edgerton. Hot water treatment of sugarcane. The Sugar Bulletin 21 (18):139-140. 1943.
59. Forbes, I. L., and P. J. Mills. Disappearance of virus from mosaic-diseased sugarcane plants. Phytopathology 33:713-718. 1943.
60. ——————, and C. B. Gouaux. Co. 290 and the red rot. The Sugar Bulletin 21 (23):202. 1943.
61. Edgerton, C. W., and F. Carvajal. Recent investigations on the red rot of sugarcane. The Sugar Bulletin 22 (4):26-29. 1943.
62. Carvajal, Fernando, and C. W. Edgerton. The perfect stage of Colletotrichum falcatum. Phytopathology 34:206-213. 1944.
63. Forbes, I. L., and A. L. Dugas. The red rot and borer problem in Co. 290. The Sugar Bulletin 22(9):70. 1944.
64. Dunckelman, P. H., and C. W. Edgerton. Report on cooperative tests with the hot water treatment of sugarcane. The Sugar Bulletin 22 (18):140-144. 1944.
65. Forbes, I. L., P. J. Mills, and P. H. Dunckelman. The role of red rot in the windrowing for seed of present day sugarcane varieties in Louisiana. The Sugar Bulletin 22 (18):148-149. 1944.
66. Edgerton, C. W., and Fernando Carvajal. Host-parasite relations in red rot of sugar cane. Phytopathology 34:827-837. 1944.
67. Dunckelman, P. H., and C. W. Edgerton. Report on cooperative tests with the hot water treatment of sugarcane. The Sugar Bulletin 23 (18):138-141. 1945.
68. Forbes, I. L., and P. J. Mills. Movement of mosaic virus through sugar-cane seed pieces. Phytopathology 35:705-709. 1945.
69. Flint, Lewis H., and Charles F. Moreland. A study of the stomate in sugarcane. Amer. Jour. Botany 33:80-82. 1946.
70. Dunckelman, P. H., Wm. J. Luke, R. T. Gibbens, and C. W. Edgerton. Response of sugarcane to the hot-water treatment. La. Bul. 401. 1946.
71. Brown, Clair A., and W. H. Carter. Weed investigations. La. Bul. 402. 1946.

72. Edgerton, C. W. Hot water and seed cane tests. The Sugar Bulletin 24 (18):155-157. 1946.

73. Brown, Clair A., and Quintin L. Holdeman. Controlling alligator weed in sugarcane with 2,4-D. La. Bul. 410. 1947.

74. ————————, and ————————. Alligator weed control in sugarcane with 2,4-D. The Sugar Journal 9 (8):2-4. 1947.

75. ————————, and T. C. Ryker. The control of alligator weed in sugar cane and weeds in rice with 2,4-D. Down to Earth 2 (4):6-10. 1947.

76. Forbes, I. L. The future of Co. 290 in Louisiana. The Sugar Bulletin 25 (17): cover. 1947.

77. Steib, R. J., and S. J. P. Chilton. Red rot—method of infection. The Sugar Bulletin 25 (18):137-138. 1947.

78. Cooper, W. E., and S. J. P. Chilton. Root rot of sugarcane. The Sugar Bulletin 25 (18):139. 1947.

79. Barr, Harold T., and Clair A. Brown. Weed control with 2,4-D. Agricultural Engineering 28:341-342. 1947.

80. Chilton, S. J. P., and Rene Steib. Red rot. The Sugar Journal 10 (1):10-13. 1947.

81. Chilton, S. J. P., and P. J. Mills. Effect of red rot on yields. The Sugar Journal 10 (1):13, 19. 1947.

82. ————————, and ————————. Hot water treatment. The Sugar Journal 10 (1): 19. 1947.

83. ————————, and W. E. Cooper. Root rot of sugar cane. The Sugar Journal 10 (1): 19-20. 1947.

84. Steib, R. J. Johnson grass seed germination. The Sugar Journal 10 (6):14-15. 1947.

85. Chilton, S. J. P., P. J. Mills, and R. J. Steib. Progress on red rot in 1947-48. The Sugar Journal 10 (6):16. 1947.

86. McCleskey, C. S., L. W. Faville, and Rex O. Barnett. Characteristics of Leuconostoc mesenteroides from cane juice. Jour. Bacteriology 54:697-708. 1947.

87. Brown, C. A., Q. L. Holdeman, and E. S. Hagood. Weed control in sugarcane. The Sugar Journal 10 (11):15. 1948.

88. ————————. Chemical weed control in sugarcane. The Sugar Journal 10 (8):9-10. 1948.

89. Ryker, T. C. Preliminary tests with ammonium trichloroacetate as a herbicide. The Sugar Journal 10 (11):16. 1948.

90. Stamper, E. R., E. S. Hagood, H. T. Barr, and S. J. P. Chilton. 2,4-D and Johnson grass seedlings. The Sugar Bulletin 27 (9): 129, 137-138. 1949.

91. Chilton, S. J. P. Johnson grass control. The Sugar Bulletin 27 (10):149. 1949.

92. Stamper, E. R., and S. J. P. Chilton. Weed control in sugarcane. The Sugar Bulletin 28 (4):54, 57-59. 1949.

93. Phillips, Ruth Patterson, and S. J. P. Chilton. Studies on Johnson grass seed populations in the sugarcane areas of Louisiana. The Sugar Journal 12 (1):3-5, 13-14. 1949.

94. Guiscafre-Arrillaga, J. Formation of galls in stems and leaves of sugar cane in response to injections of growth-regulating substances. Phytopathology 39:489-493. 1949.

95. Cooper, W. E., and S. J. P. Chilton. Studies on antibiotic organisms. I. Actinomycetes antibiotic to Pythium arrhenomanes in sugar-cane soils of Louisiana. Phytopathology 40:544-551. 1950.

96. Stamper, E. R., and S. J. P. Chilton. The control of Johnson grass in sugarcane fields. La. Bul. 442. 1950.

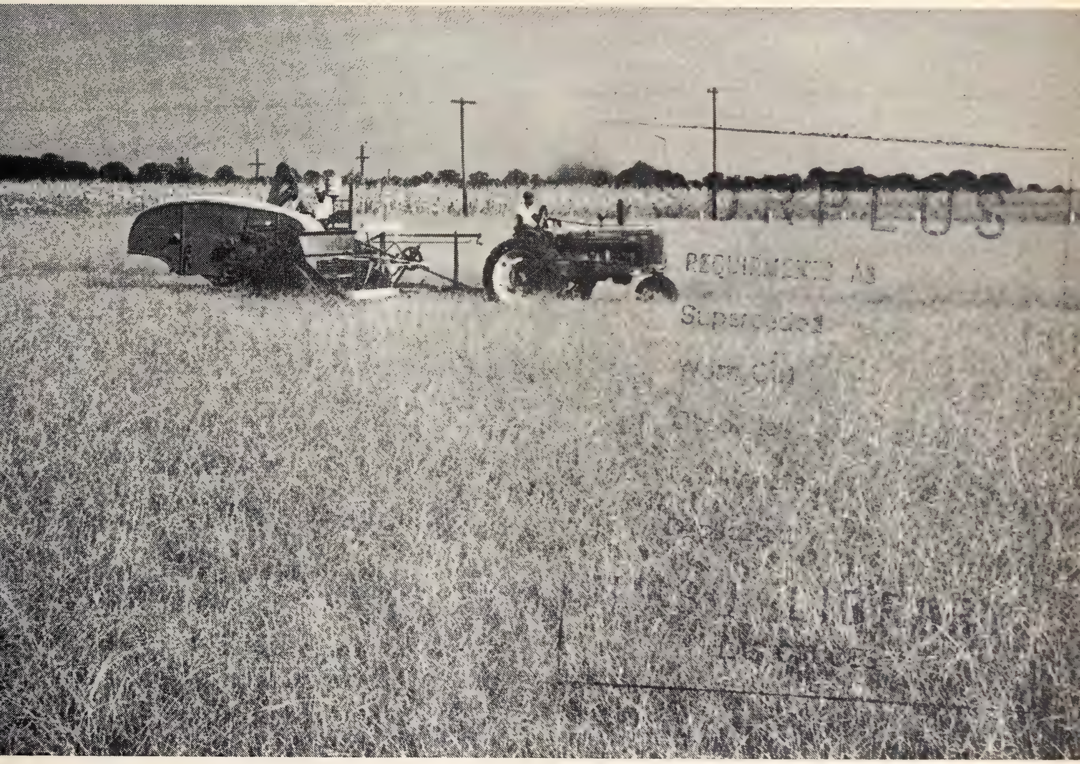
E5b

Louisiana Bulletin No. 449 May 1951

LIBRARY
FEB
NEW MEXICO
UNIVERSITY

IMPROVEMENT OF NATIVE DALLIS GRASS IN LOUISIANA

By C. R. OWEN



SURPLUS
REQUIREMENTS AS
Superseded

Harvesting Seed of New Strains of Dallis Grass at the Louisiana Experiment Station.

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. Taggart, *Director*

TABLE OF CONTENTS

Section I

Introduction 3

Some Problems Involved in Dallis Grass Improvement 4

Variation in Seed Quality Affected by Seed Source and by the Environment in which Grown 5

Breeding for Seed Improvement 7

Evaluation of New Strains for Seed and Forage 13

Pure Seed Fractions Fluctuate with Strains, Seasons and Years 15

Seed Quality of Strains Grown in Different Sections of the State 19

Seed Formation in the Absence of Ergot 26

Section II

Seed Production with Dallis Grass 27

Planting Grass for Seed Production 28

Planting the Seed 29

Harvesting Seed 31

Cleaning Seed 35

How Long will Dallis Grass Seed Retain Viability in Storage? 36

Frequency of Harvesting Seed 36

How to Determine When Seed Fields are Ready for Harvesting 38

Pastures and Seed Production 38

Seeding Rates and Quality 39

Summary 40

Improvement of Native Dallis Grass (Paspalum dilitatum) In Louisiana

C. R. Owen*

SECTION I

Introduction

During the past twenty-five years widespread interest has developed in the cotton belt states in Dallis grass for pastures. Its value has not been fully realized because of the limited supply and high cost of seed. Previous to this period almost all of the seed used for planting was imported from Australia. The high cost of imported seed together with the increased demand has stimulated considerable interest in seed production in Louisiana as well as in other southern states. Early attempts at seed production were somewhat discouraging. The seed was harvested from volunteer stands with rather indiscriminate plans and methods; consequently, the results were low acre yields of seed variable in quality but principally low in viability.

A project was initiated by the Louisiana Agricultural Experiment Station in 1940 to investigate the causes for the low viability of domestic seed and to seek methods for improvement. The problem resolved itself into two phases: (1) the improvement of the native stocks by appropriate breeding methods and (2) a study of the methods employed in producing, harvesting, and processing the seed for the market. It has been possible to include both phases only to the extent that seed production studies were imperative in testing and evaluating new strains arising from the breeding program. Certain of our seed growers have extended cooperative assistance by permitting the use of their field operations for observations and experimental use. Considerable information was gained about the problems in Dallis grass seed production from these field studies. The problems involved in seed production, harvesting, and processing may not appear complex to those not familiar with the grass. Their solution, however, will probably require the cooperative efforts of specialists in the related fields of agricultural research.

Dallis grass is native to Northern Argentina, Uruguay and Southern Brazil. It was introduced into the United States in the vicinity of New Orleans, evidently by accident[1] and has since spread over much of the state by natural means. Although this species of grass is known to botanists as **Paspalum dilitatum,** in the United States it has been given the common name Dallis grass. It was so named for A. T. Dallis of LaGrange, Georgia, who first grew it and, through his enthusiam, was instrumental in its spreading throughout the southeastern states. As a matter of personal interest, a brief account of his activity was received in a letter from Render Dallis, nephew of the late Mr. Dallis, dated August 3, 1950. He stated that as a boy he assisted his uncle in gathering seed by hand from his meadows. As State Fish Commissioner and at the same time in charge of the Agricultural exhibits at the state fair, his uncle made many contacts with farmers from other areas. Anyone found to be interested in pasture grasses was given a small bag of seed of this new grass. His active interest was during the years about 1900 to 1906. No account is given of where he obtained the seed.

---

*Associate Agronomist, Louisiana Agricultural Experiment Station.

[1] Piper, C. V., *Forage Crops and Their Culture,* The MacMillan Co., New York, 1927.

Dallis grass is referred to only as Paspalum in an early publication of the Louisiana Experiment Station:[2] "The hay cut from headlands and ditch banks used to feed livestock on sugar plantations was composed of the Paspalums (chiefly dilitatum), Bermuda and Crab grass." The general statement would indicate that this grass was spread over much of southern Louisiana at that time. Other experiments with grasses and forage crops reported by the Louisiana Experiment Station about this time apparently did not include Paspalum; at least no mention was made of it. Dallis grass is recorded by specimens from Arkansas in 1879; Texas, 1880; and in Louisiana, 1883.[3] This species is now widely spread over the cotton belt states from North Carolina to Florida and west to Texas. Dallis grass has also been successfully grown in the San Joaquin Valley of California under irrigation.

Some Problems Involved in Dallis Grass Improvement

Prominent in Dallis grass seed fields in Louisiana is the extent of damage caused by ergot. This condition is more severe during certain years and seasons than others. It is obvious that resistance to this disease should be among the first characteristics which a strain of grass should possess for improvement in seed quality. It is the consensus of opinion that the presence of the disease on the seed heads is the principal objection to Dallis grass for pastures. It is more or less assumed that ergot is the cause for the low viability of the seed produced within the southern states. Thus, it would seem foremost in importance that an attempt be made to determine the extent to which a breeding program may assist in reducing the damage done to the seed, by attempting to isolate strains which are more resistant to attacks by this disease.

The techniques involved in the plant breeding for better seed production in species which are perennial and where seed, after all, is secondary in importance are unique. Pasture grasses are planted and grown specifically for animal production. Here the formation of seed is objectionable for the reason that ordinarily a seed producing plant is approaching maturity, and it is well known that as plants approach the mature stage, their value for forage decreases. It therefore is considered best in pasture management to permit the least possible portion of the herbage to reach such a stage. It is well known that mature plants are less palatable and lower in feeding value than in the growing stage. On the other hand, seed is essential for establishing and renovating pastures. Presently there is no substitute for seed with certain crops. In an improvement program for grass with certain seed characters, the problem must be approached cautiously lest a type be developed which would be less desirable for the purpose for which the crop is intended. Consideration for forage characteristics prolongs the program. While progeny tests with annual crops such as cotton, corn or rice require only one season, pasture crops which grow more than one year require two to three seasons. It is important to know how the plants perform the second and perhaps the third year after planting. Performance of grass in the matter of forage production month after month during the growing season is of exceptional value. It has been the practice in this program to continue the study with each planting of Dallis grass progenies for two years. Such practices delay the program and it requires longer to obtain the effect of subsequent generations on the yield of the strains. In spite of this, however, there are certain advantages to be gained by the perennial habit of growth. Repeated seed and forage harvests may be made from the same plants for more than one season and it is possible to determine the effect of seasonal variations upon the quality of seed produced.

---

[2] *Grass, Clovers, Forage Crops and Small Grains,* Bul. 19, Second Series, La. Agri. Exp. Station, 1892.

[3] Piper, C. V., *Important Cultivated Grasses,* Farmers Bulletin 1254, pp. 30-33, U.S.D.A.

Variation in Seed Quality Affected by Seed Source and by the Environment in which Grown

At the beginning of the program with Dallis grass seed improvement, preliminary experiments were conducted to obtain information regarding certain of the factors affecting seed quality. In the spring of 1942 lots of seed which had been produced by native grass were obtained from a number of different sources. Seed was also included from a shipment of imported seed. It had been suggested by certain interested individuals that since seed which came from Australia was of better quality than domestic seed, perhaps there would be an advantage in the use of such seed for planting where seed was to be harvested. An entry from imported seed was included in the test in order to obtain this information.

Early in the spring of 1942, the seed from each lot was germinated in sand flats in the greenhouse. After the seedlings had formed permanent root systems they were transplanted to six-ounce soda cups which had been filled with soil. The cups were placed on a greenhouse bench, watered daily, and allowed to remain until the plants had overcome the shock of being transplanted and were well rooted, or about three weeks. Afterwards they were transplanted to the field in seed yield trials. These experiments were planted at Baton Rouge on Olivier silt loam, and at the Northeast Louisiana Experiment Station at St. Joseph on Sharkey clay loam with the cooperation of Mr. C. B. Haddon, Superintendent. The plots were one two-hundredth acre in size and there were four replications. The plants were spaced 21 inches in the drill on rows 42 inches apart. The tests on the Olivier soil were fertilized moderately. No fertilizer was used on the river bottom soil at St. Joseph. The plants were set in the field in late May. One seed harvest was made the following September. The plots were harvested by hand, by clipping the ripe heads from the plants and placing them in muslin bags where they remained until dry. The seed was threshed by scrubbing the heads between rubber matting. Samples were taken for germination after the seed was cleaned of foreign material. Only a portion of the seed was harvested at St. Joseph and the yields are not recorded. Sufficient seed was clipped from the plants for adequate samples of each entry.

The results of this experiment are given in Table 1. Since it was only a preliminary trial it was conducted for only one season. Seed was sent to the Alabama State Seed Laboratory for analysis and germination. Although the difference between entries for seed yield is not great, it is sufficient to be considered as real. A more significant feature of the experiment is the difference for pure seed between seed sources. The fact that the Australian seed produced poorer quality seed than certain native lots at Baton Rouge and is no better than the average at St. Joseph, should discourage any anticipated practice of using imported seed instead of domestic seed for planting fields where seed production

TABLE 1.
Yield and Quality of Seed Produced from Seed Collected from Different Sources
(Grown at Baton Rouge and St. Joseph—1942)

Source	Yield in Lbs. per Acre	Pure Seed Per Cent		Germination Per Cent*	
	Baton Rouge	Baton Rouge	St. Joseph	Baton Rouge	St. Joseph
Native Seed	122.8	21.7	30.6	61.9	81.7
Native Seed	110.9	25.2	23.4	48.6	81.3
Native Seed	83.5	16.3	19.9	47.5	77.8
Native Seed	80.2	17.3	24.8	47.5	86.2
Native Seed	73.1	16.9	27.6	61.9	81.0
Native Seed	70.9	17.4	25.1	55.0	86.0
Imported Seed	69.4	10.4	24.4	64.9	66.8
Native Seed	83.5	17.4	26.4	54.8	81.3
Average	86.9	17.8	25.2	55.3	80.3

---

* With germination tests only the pure seed are used. The fact that a portion of Dallis seed is classed as inert is due to the inability of that portion to germinate in any environment.

is intended. Except for environmental influence, there is no explanation for the occurrence of the difference in the pure seed content and germination between seed produced in the two locations. The fact that seed produced at St. Joseph contained on the average 7.4 per cent more pure seed, and that 25 per cent more of these germinated, than seed produced from identical plants at Baton Rouge warrants further study. The results from additional work with this subject are discussed in a later section.

Breeding for Seed Improvement

Along with the preliminary tests with Dallis grass seed sources, experiments were begun to determine the extent to which the seed production potential of the species might be improved by certain plant breeding methods. About 1,000 individual plant selections were made from a space-planted nursery grown from native seed procured in four different fields.

Seed of the selected plants was planted in progeny yield trials. The best progenies from these were carried forward into new-strains tests. From the selected individual plants, 48 were planted for evaluation during the first season. These were selected from a planting made with four seed sources designated as lots A, B, C, and D. There were about 250 plants selected from each source of seed.

STRAIN B230 — Among the progenies selected for further testing was plant selection number 230 from seed source B. The strain resulting from this progeny was included in the new strains throughout the testing period from 1943 to 1948. The performance of this strain has been outstanding for forage production and better quality seed. A record of its performance is given in Tables 4, 5, 6, 7 and 8. The source of seed from which the original selections were made was a field of native grass in Avoyelles Parish, near Simmesport, Louisiana.

This strain has no characteristic markings which would help to distinguish it from other native grass. It has excelled in forage production, which may be seen in Table 4. For seed production it is not exceptional in quantity, but for quality of seed the performance is above the average of the other selected strains. For seed quality as measured by the per cent pure seed, Strain B230 exceeds the average for the group by 27 per cent. The increase in pure seed content is at the expense of ergot infection. It has had 33 per cent less ergot infected seed than the average. It has more empty florets than the average, as shown in Table 7. These tests were conducted at Baton Rouge.

In the spring of 1943, the breeding program was expanded. Ten different lots of seed were collected from as many sources. Seedlings which were started in the greenhouse in February from each of the ten seed sources were transplanted to the field in May. They were space-planted in checks 42 inches apart so that the growth tendency of each individual plant might be observed. In September, 1943, seed of more than 3,000 plants was harvested and placed in separate bags

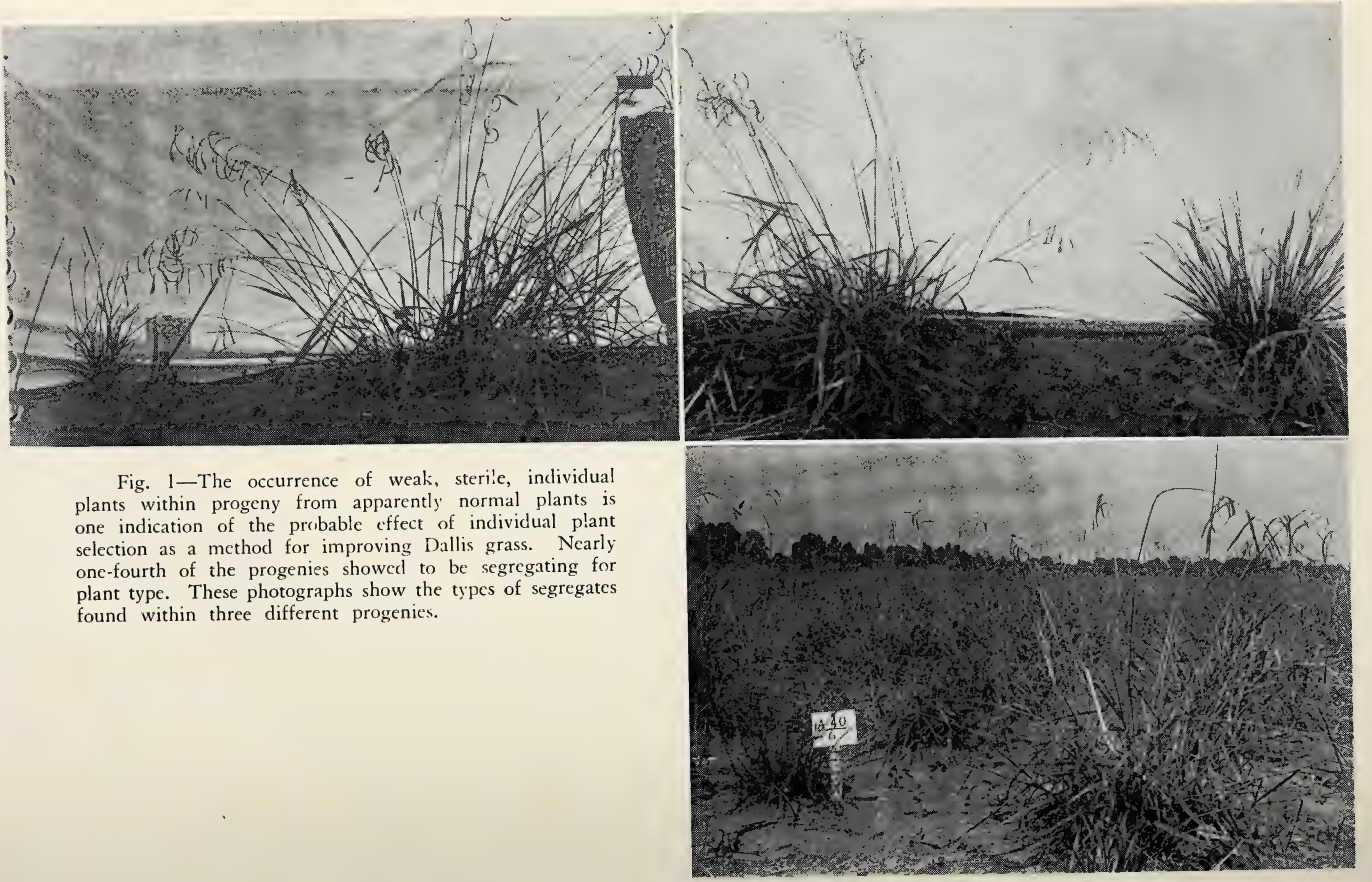


Fig. 1—The occurrence of weak, sterile, individual plants within progeny from apparently normal plants is one indication of the probable effect of individual plant selection as a method for improving Dallis grass. Nearly one-fourth of the progenies showed to be segregating for plant type. These photographs show the types of segregates found within three different progenies.

for laboratory studies. From these, about 150 were selected to be planted in the breeding nursery in 1944. Finally, 144 selections were planted in a progeny nursery test in May, 1944. The method used in planting was very similar to that of earlier experiments. The progeny rows or plots had been arranged in an experimental design known as the triple lattice, using three replications.

The land on which the test was planted was Olivier silt loam. It had not been previously cultivated for a number of years. Adequate fertilizer was used to promote normal growth of the plants, and the land was cultivated sufficiently to keep weeds in check. Excellent growth was obtained from the grass planted on this soil and a very good crop was harvested in early August. The seed was threshed on a small nursery thresher, cleaned of foreign material, and weighed. Afterwards, the seed was sampled for analysis. Analysis with Dallis grass seed consists of separating the seed into its various components and determining the percentage of each by weight. With certain exceptions the analyses were conducted in accordance with the standards furnished by the American Association of Seed Analysts. The exceptions were: the inert fraction was separated into empty florets and diseased florets and the pure seed was not germinated. Germination was not done because adequate facilities were not available at the time. The samples were taken from the total production since none of the seed was

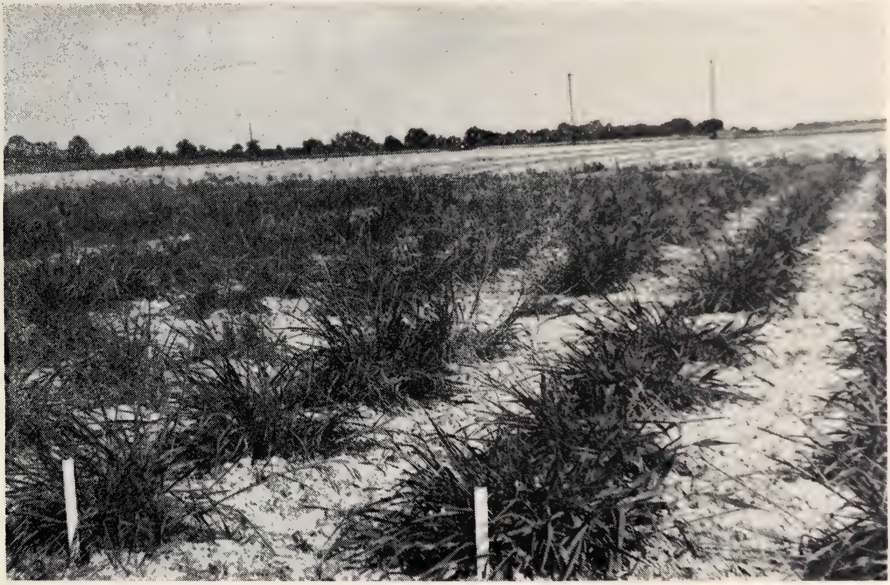


Fig. 2.—Dallis grass nursery showing progeny tests the second year. Photographed in April. Forage development observations were made on space-planted progenies at intervals during the growing season. Seed was harvested as a crop matured.

removed in the cleaning process. Only straw, dust, and other grass seeds were separated prior to sampling.

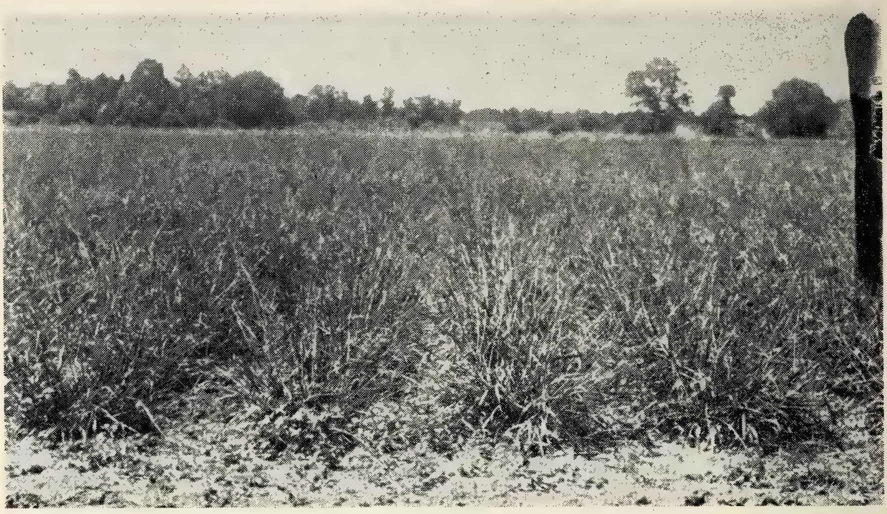


Fig. 3.—Space-planted progeny nursery at seed harvest time.

The following October a second seed harvest was made from the progeny test. The procedures for harvesting, processing, and analyzing were the same as for the preceding seed crops. The fall crop was somewhat lower in yield than the summer crop, as shown in Table 2. The seed of progenies was of better quality on the average than for the previous August.

The progeny test was continued during the season of 1945. Active growth began about April 1, and soon afterwards the middles were cultivated and the grass fertilized with 400 pounds of 4-12-8 fertilizer per acre. The first seed crop was ready for harvesting June 15. The procedures for harvesting, processing, and analyzing the seed were the same as for the harvests made in 1944. A second harvest was made in August but excessive rains in September prevented the seed harvest expected in October.

The results of the progeny tests conducted during the two years are summarized in Tables 2 and 3. With as many as 144 entries it was thought best to present these results in a form condensed as much as possible, and for that reason the frequency table has been used. Obviously this method of presentation is intended principally for reference for those interested in the more technical phase of the work. The original plants were selected on the basis of vegetative vigor. Seed weights were considered only after they were taken in the laboratory. The wide range in variability for seed weight provided an interesting phase for study. The range in seed yield in the parent plants

TABLE 2.

Seed Weights of Selected Plants and Their Progenies Illustrated by Frequency Distribution

Weight of Seed of Parent Plant, Expressed in Grams

	Mid Point of Class															
Class	5	10	15	20	25	30	35	40	45	50	55	60	65	70	**Mean**	**C.V.%****
Parent*	18	9	5	6	21	9	16	19	11	8	10	3	3	1	31.2	54.5

Yield of Seed of Progeny, Pounds per Acre

	Mid Point of Class																	
Class	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	Mean	C.V.%**
August, 1944							3	3	10	12	22	32	27	26	5	4	261.1	14.4
October, 1944	1	13	24	42	45	12	6	1									102.6	24.8
June, 1945		1	2	31	53	39	13	4	1								127.1	14.9
August, 1945			3	4	25	54	41	9	4	4							146.1	16.4

* Some of the parent plants produced insufficient seed for analysis after planting.

** Coefficient of variation.

TABLE 3.

Seed Characteristics of Selected Plants and Their Progenies in 1943-45

	Frequency Distribution of Parent and Progeny 1944-45 Mid Point of Class																											
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	Mean	C. V.%*
Pure Seed — Per Cent by Weight																													
Parent-Oct. 1943			13	11	23	27	12	10	12	8	4	2	6	4	5													22.5	41.7
Progeny-Aug. 1944		2	24	52	37	14	9	1	4	1																		14.7	27.2
Progeny-Oct. 1944	1	0	5	3	6	8	32	47	19	19	0	1	2															24.3	17.5
Progeny-June 1945						1	2	2	16	38	33	27	16	8	1													33.3	10.8
Progeny-Aug. 1945							1	2	1	2	15	23	37	18	22	14	9											41.0	11.2
Empty Florets — Per Cent by Weight																													
Parent	2	9	23	24	24	11	23	6	7	1	2	2	0	0	0	2	0	0	0	0	1	0	0	1				17.1	55.6
Progeny-Aug. 1944		2	18	43	52	16	5	0	1																			14.1	67.8
Progeny-Oct. 1944			4	7	8	14	28	31	27	7	4	6	0	0	1													23.2	26.5
Progeny-June 1945					1	8	27	56	27	11	4	3																25.0	14.7
Progeny-Aug. 1945						2	7	16	42	43	19	5	1	2														28.6	13.7
Diseased Florets — Per cent by Weight																													
Parent-Sept. 1943		1	1	0	1	0	1	1	0	2	1	2	5	3	7	2	10	3	10	11	15	20	11	12	11	8		60.2	22.8
Progeny-Aug. 1944																	2	0	2	2	9	19	20	39	27	12	3	70.8	7.5
Progeny-Oct. 1944											3	0	2	4	11	16	18	19	9	10	8	8	8	15	5	1		52.4	12.3
Progeny-June 1945							2	0	2	5	6	14	33	29	24	15	3	2	1	1								41.4	14.3
Progeny-Aug. 1945					1	6	8	15	29	36	30	9	4	5														30.2	15.8

*Coefficient of variation.

was from about five grams to seventy grams, or from about 1/100 to 1/7 of a pound. Ordinarily only the higher yielding plants would be taken, but within a species in which little work has been reported regarding the breeding behavior, it was considered worthwhile to include a wide range in seed yield. The seed was not analyzed until the following season; as a result no selection for seed quality was possible.

The results from the analysis of the seed samples are given in Table 3. A fairly wide range in pure seed was present within the parent plants in spite of the fact that this characteristic was not under consideration at the time. Incidentally, the parent-progeny trend of relationship for this character is very good (r=.74). This is evidence that seed quality may be improved materially by the simplest method of breeding, that is by selecting plants with the best seed. Variation in pure seed content has appeared in the material in spite of high incidence of ergot infection during certain seasons. In seasons of heavy disease infection of the florets the percentage of florets escaping, even among the most fertile progeny, was considerably lower than during lighter epidemics. This is further exemplified in the new-strains tests.

The separation of the inert matter into empty florets and diseased florets was done on the basis of appearance. While little difficulty was encountered in separating the ergot sclerotia from empty florets, there was a class of apparently disease infected empty florets which were not so easy to distinguish from empty florets. Generally, if the discoloration appeared inside the florets they were classed as diseased; if on the outside, they were classed as empty.

Evaluation of New Strains for Seed and Forage

From the experiments which were conducted to determine the relative value of the selected plants for seed and forage improvement, 13 were carried forward to the new-strains test. The experiment was planned to compare these strains for seed quality, seed yield, and for-

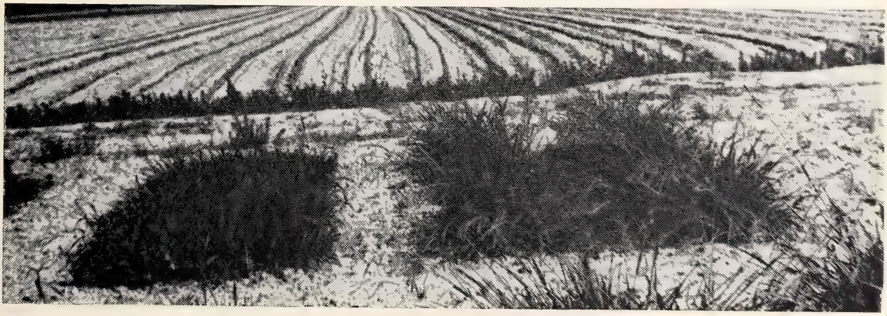


Fig. 4.—New strains tests, 1947. Forage harvests were made from the broadcast plots (left) while seed production was studied on the row plots (right). There were 64 pairs of such plots in the test.

age production. Three strains which originated in the progeny test in 1942 were included for comparison. The experimental design used was such that each of these characteristics of the strains could be compared adequately. There were four replications.

The plots from which the seed was to be harvested were planted in drills, 42 inches apart. The seeding rate was 5 pounds per acre. Adjacent to the row plots, seed of the same strain was sown broadcast at the rate of 25 pounds per acre. The test was located on Olivier silt loam. The land had not been cultivated for some time previously and likely had not been fertilized before. It had grown up in broom sedge, blackberry vines, and large weeds and obviously was low in natural fertility. To help correct this condition an application of 400 pounds of 4-12-8 fertilizer per acre was made before planting. The land was prepared well by disking, followed by breaking with mouldboard plows, also followed by disking and harrowing. The fertilizer was aplied just before planting and worked into the soil to a depth of three to four inches. The seed was sown May 3, 1946, on the surface of the mulched soil and covered by rolling with a cultipacker.

The grass was up to a stand within two weeks. Weeds were kept down on the broadcast plots by mowing as often as necessary until the grass had become established. Forage production was measured by mowing to simulate grazing. Seed harvests were made in August and October in 1946; June, August, and October in 1947; and June and August in 1948. The forage was clipped each month from April through September each year during the test.

Seed was harvested by clipping the seed heads with grass shears and curing the heads in muslin bags suspended in the greenhouse during the summer months. They were threshed on a nursery thresher and cleaned. Afterwards they were sampled and analyzed for pure seed, empty florets, and diseased florets.

Forage yields are given in Table 4. The yields are expressed in pounds of green weight per acre. Monthly production is the average for three seasons. Strains are arranged in order of the total forage production for the year. The total yield is also the average for three years.

Forage production studies show that even among groups of selected strains, there are considerable differences in productive capacity. The total annual production between the high and low entry as an average for three years ranged from 18,350 to 25,490 pounds per acre, a difference of 7,140 pounds. The significance of this is probably somewhat obscure, but it is intended to show to some extent, the possibilities of improving pasture grasses by breeding methods. This of course is only one instance. There are other examples of improvement of pasture grass in the South. An outstanding example is with Bermuda grass. This forage test illustrates that such improvement may also be accomplished with Dallis grass and incidentally a number of other species of pasture plants.

The fertilizer treatment of this test during the years 1947 and 1948 was 400 pounds of 4-12-8 applied in April and 200 pounds of nitrate of soda per acre applied July 1. Nitrogen fertilizer applied in summer as a top-dressing was effective in stimulating growth during July and August. Its effect could be seen even through September. The response was somewhat more pronounced in certain strains than in others. The distribution of forage production of this grass is very good from April throughout the remainder of the year. No harvests were made after October, although the grass continued to grow until freezing weather set in.

TABLE 4. Forage Production of New Strains of Dallis Grass in Pounds of Green Weight per Acre, Average for 1946, 1947, and 1948

Strain	April	May	June	July	August	Sept.	Total
47	2,711	4,632	5,459	4,555	4,577	3,556	25,490
413	2,458	4,236	5,173	4,379	4,153	3,589	23,988
B230	2,422	4,360	4,688	4,438	3,967	3,707	23,583
430	2,750	3,397	4,576	4,465	4,696	3,600	23,484
419	2,361	3,704	4,020	4,244	3,816	3,829	21,974
4144	2,290	3,647	4,258	3,709	3,935	3,714	21,553
B247	2,370	3,477	3,975	3,574	3,829	3,620	20,845
4130	2,342	3,726	4,640	3,741	3,425	3,562	21,436
483	2,039	3,534	4,190	3,955	3,616	3,403	20,737
A182	2,181	3,432	3,977	4,175	3,606	3,353	20,671
4132	1,774	3,262	4,346	4,031	3,523	3,161	20,097
451	1,780	3,386	3,805	4,126	3,437	3,444	19,978
415	1,932	3,375	3,769	3,894	3,433	3,112	19,515
4123	1,824	2,956	3,896	3,848	3,584	3,111	19,219
4134	1,817	2,673	3,918	3,918	3,542	3,273	19,141
4131	1,858	3,205	3,964	3,344	3,112	2,867	18,350
Average	2,182	3,563	4,291	4,025	3,766	3,429	21,256

Problems in seed production are the major factors in this research, but since the grass is to be used for forage it was believed important to present the forage production first. Seed harvests were made each year, and the data resulting from seed studies are presented in Tables 5, 6, 7, and 8. Seed production for each harvest, and the total for the year, are given in Table 5. Tables 6, 7, and 8 show the performance of the 16 strains for seed quality. Seed production for most months for the duration of this test was not exceptional, although the total seed produced each year was considerably above the better yields obtained within the state. Attention is here called to strains number B230 and 430. These strains are not outstanding for seed production, but their record for persistent production of better quality seed is exceptional for domestic seed.

Pure Seed Fractions Fluctuate with Strains, Seasons, and Years

The content of pure seed contained in harvests from 16 strains

TABLE 5. Seed Production of New Strains of Dallis Grass,, 1943-1948

(Parents expressed in Grams per Plant, Progeny in Pounds per Acre)

	Parent	Progeny Nursery — Space-Planted						New-strains Test — Planted in Normal Width Rows									
STRAIN	1943	1944			1945			1946			1947				1948		
NO.	Oct.	Aug.	Oct.	Total	June	Aug.	Total	Aug.	Oct.	Total	June	Aug.	Oct.	Total	June	Aug.	Total
430	33.4	317	120	437	115	132	247	223	127	350	138	227	303	668	157	122	279
B230*	--	176	86	262	120	162	282	205	132	337	106	192	209	507	167	130	297
B247*	--	177	69	246	122	126	248	158	124	282	138	198	239	574	154	139	293
46	23.4	173	97	270	150	180	330	181	109	290	175	220	302	697	168	125	293
47	28.9	319	160	479	142	155	297	240	130	370	194	218	293	705	196	129	325
413	26.4	298	166	464	120	199	319	188	105	293	156	228	312	696	185	138	323
419	58.0	347	129	476	109	227	336	199	124	323	154	201	225	580	190	123	313
451	30.1	194	51	245	167	169	336	173	48	221	166	174	191	531	191	106	297
415	38.9	355	90	445	194	146	340	193	61	254	163	179	195	537	179	118	297
483	31.0	296	74	370	160	171	334	191	48	239	184	174	219	577	152	113	265
4123	34.5	323	72	395	175	209	384	194	79	273	172	212	219	603	158	112	270
4130	18.1	185	103	288	111	132	243	185	111	296	139	208	241	588	168	127	295
4131	21.0	271	64	335	144	171	315	94	36	130	135	166	183	484	135	103	238
4132	60.0	305	53	358	139	168	307	246	83	329	181	218	235	634	160	108	268
4134	18.6	281	69	350	153	193	346	265	76	341	162	225	233	620	175	113	288
4144	65.5	219	127	346	148	137	285	227	126	353	139	220	282	641	161	108	269
Ave.	30.5	264.7	95.6	360.4	141.8	167.3	309.3	197.6	94.9	292.6	156.4	203.8	242.6	602.6	168.5	119.6	288.1

*Strain isolated earlier in the program used as checks, not planted in same test with progeny 1944 and 1945.

is given in Table 6. Beginning with the parent plant harvested in October, 1943, the pure seed content of the 16 strains is given for each seed harvest through 1948. For the years 1944 and 1945 the seed was harvested from the same plants in the progeny nursery. In 1946, 1947, and 1948 seed was produced on plots seeded as the new-strains test. Two seed harvests were made each year except in 1947, when it was possible to make three. Only two were possible during 1944 and 1946 because the tests were planted in May of those years. In 1945 and 1948 the weather conditions prevented harvesting in October.

From the results recorded in Table 6, it is evident that certain of the strains are capable of producing better quality seed than others. Attention is again directed to strains B230 and 430. Seed quality of these better strains is influenced considerably by the seasons during which the seed developed. With strain 430, for the twelve harvests, 35.8 per cent of the seed harvested from the plants was classed as viable. This is an increase of 32 per cent above the average of all strains during the five-year testing period. Strain 430 was followed closely by strain B230 with an increase of 27 per cent. Seasonal effect upon the seed of even these strains is somewhat pronounced. The range in purity of strain 430 extends from 24.3 per cent in August, 1948, to 46.5 per cent in August, 1945. The effect of seasons on seed quality in certain other strains is greater. With strain 4132, for example, the range extends from 15.8 per cent in June, 1948, to 52.5 per cent in August, 1945.

In addition to the pure seed portion of Dallis grass seed there is the inert fraction. This is also referred to as the inert seed content. It is simply "dead weight" to be exact, although much of it looks exactly like seed to the casual observer. In the analysis reported here the inert fraction is separated into empty florets and diseased florets. Tables 7 and 8 show the per cent by weight of empty florets and diseased florets contained in seed samples for each strain during the period tested.

The portion of empty florets for each harvest of the new strain is given in Table 7. Empty florets are so called for obvious reasons. In the absence of ergot they alone would compose the inert fraction of Dallis grass seed. Empty florets look exactly like seed from outward appearances. However, upon examination they are found to collapse when pressure is applied, as contrasted with the flinty texture of pure seed and the spongy appearance of the diseased floret. In general, however, those florets which did not have the fungal discoloration inside the "glumes" were classed as empty.

In Table 7, it may be seen that the content of empty florets fluctuates from season to season almost parallel with pure seed. A study of Tables 6, 7, and 8 will reveal that both the empty florets and pure seed fractions vary inversely with the diseased or ergoty content. For example, in August, 1944, pure seed content for all entries averaged 18.6 per cent and empty florets 16.1 per cent, while the diseased seed

TABLE 6. Pure Seed Content of New Strains of Dallis Grass, 1943-1948

(Expressed in Per Cent by Weight)

Strain No.	Parent	Space-Planted Progeny				New-strains Test — Planted in Standard Rows								Per Cent of Average
	1943	1944		1945		1946		1947			1948		Average	
	Oct.	Aug	Oct.	June	Aug.	Aug.	Oct.	June	Aug.	Oct.	June	Aug.	1943-48	
430	41.0	28.5	40.5	43.5	46.5	36.7	33.2	26.2	43.7	26.7	39.5	24.3	35.8	132
B230*	--	43.1	33.5	44.5	45.8	35.2	37.5	21.2	38.5	24.7	28.8	23.0	34.2	127
413	20.0	12.7	29.3	37.0	48.5	32.0	35.0	28.5	33.2	19.2	26.8	22.5	28.7	106
4132	46.7	21.0	28.5	31.5	52.5	31.7	25.5	25.0	33.0	16.0	15.8	16.0	28.6	106
4123	45.2	17.7	30.7	36.2	51.2	30.5	22.7	21.7	29.2	19.2	19.3	15.5	28.3	105
483	21.2	14.2	30.2	36.2	47.5	29.2	28.7	28.5	40.7	16.7	20.3	17.5	27.6	102
4134	22.0	26.0	26.7	40.5	47.7	26.7	25.7	25.5	33.5	17.2	21.3	17.8	27.6	102
451	16.1	16.7	28.5	41.7	50.7	33.7	24.7	28.5	31.5	16.2	20.5	17.5	27.2	101
415	19.7	11.0	29.2	42.0	50.2	25.5	24.0	27.5	28.0	16.7	20.8	20.0	26.2	97
4131	31.0	22.0	26.5	30.0	48.5	25.0	26.0	33.0	32.0	13.5	13.8	12.8	26.2	97
419	39.2	14.2	24.0	38.5	42.2	23.7	26.0	22.7	24.2	17.7	18.8	15.0	25.5	94
46*	28.0	15.5	23.0	37.2	40.5	24.0	30.0	23.2	33.7	16.7	18.5	13.0	25.3	94
B247*	--	26.0	30.5	33.0	32.8	3.7	28.0	21.2	33.0	18.2	19.8	12.0	23.5	87
4144	19.2	10.5	25.0	38.0	38.0	26.2	24.7	20.5	27.7	17.0	17.0	15.8	23.3	86
47	16.2	9.0	23.0	38.7	38.7	24.7	25.5	20.2	34.7	14.5	19.8	15.8	23.0	85
4130	17.2	9.5	22.2	32.2	35.5	20.0	23.0	23.5	25.5	17.2	15.8	14.8	21.4	79
Average	27.3	18.6	28.2	37.5	44.8	26.8	27.5	24.8	32.6	17.9	21.0	17.1	27.0	100

*Strain isolated earlier in the program used as checks, not planted in same test with progeny 1944 and 1945.

amounted to 65.0 per cent. On the other hand, in October, 1946, the pure seed content for the group averaged 27.5 per cent, empty florets 56.0 per cent, and diseased florets only 16.5 per cent. It is of interest to point to still another season. The seed harvested in August, 1945, was different from each of the above seasons. The pure seed content of the 16 strains averaged 44.8 per cent, empty florets only 27.1 per cent, and diseased florets 28.1 per cent. Seasonal fluctuation for seed quality is a factor in Dallis grass. At present there is insufficient information at hand to attempt an explanation for this. It is due obviously to weather conditions, since these seeds were produced on the same land and on the same plants with about identical treatments insofar as weather conditions would permit.

STRAIN 430 — The origin of strain B230 was discussed in an earlier section. Its merits are rivaled somewhat closely by those of strain 430. The similarity of these two strains is probably more striking than the differences, judging only from the results given in the tables. Strain 430 has shown to be more productive in total yield of seed and is hardly as resistant to ergot as B230. On the other hand, 430 has produced on the average more pure live seed. B230 has had more empty florets in the seed. Strain B230 begins growth earlier in the spring and appears to be more resistant to foliage diseases in the fall than 430.

Strain 430 originated from a single plant selection made in 1943 and was first tested in progeny trials during 1944. The source of the material from which it came was a field of native Dallis grass near Hamburg, Louisiana, in Avoyelles Parish. This strain has exceeded by 32 per cent the average pure seed content of the strains included. Ergot infected florets amounted to 28 per cent less than the average. For the duration of the test it has been consistently above the average for seed quality. The seed of this strain is being increased and it is to be released to farmers for seed production purposes in 1951.

Seed Quality of Strains Grown in Different Sections of the State

The fact that quality in Dallis grass seed is affected by the area of the state in which the seed is produced was evident from the preliminary experiments conducted in 1942 (Table 1). Experiments were planned for further study of this relationship during the year 1943. Nine strains isolated in the progeny test at Baton Rouge were planted at Baton Rouge on Olivier silt loam, at Hamburg on Miller clay loam, on alluvial soil in the Red River bottom, and at Calhoun on Ruston fine sandy loam. The experiment at Calhoun was conducted on the North Louisiana Branch Experiment Station farm, in cooperation with Dawson M. Johns, then superintendent. The one at Hamburg was in cooperation with W. T. Nolin. It is in this area that a large portion of the Dallis grass seed is produced commercially.

The procedure used for planting these tests was the same as that

TABLE 7. Empty Floret Content of Seed of New Strains of Dallis Grass 1943-1948

(Per Cent by Weight)

Strain No.	Parent	Space-Planted Progeny				New-Strains Test — Planted in Standard Rows								Per Cent of Average
	1943	1944		1945		1946		1947			1948		Average	
	Oct.	Aug.	Oct.	June	Aug.	Aug.	Oct.	June	Aug.	Oct.	June	Aug.	1943-48	
483	11.2	14.3	22.6	19.8	27.5	32.1	54.1	48.3	36.8	42.1	41.9	53.0	33.6	88
4131	12.5	12.0	8.3	20.8	26.5	36.5	49.0	49.5	42.0	40.3	48.7	58.2	33.7	89
451	17.3	13.3	21.7	26.8	20.3	31.6	54.6	48.5	37.0	34.8	42.5	55.7	33.7	89
415	16.1	13.3	24.1	24.3	24.1	33.5	60.0	51.0	40.8	37.6	47.9	47.7	35.0	92
4132	7.3	14.5	24.5	22.0	22.0	27.1	55.3	52.3	40.3	42.3	57.4	60.2	35.4	93
4134	13.5	12.3	20.8	22.5	24.6	28.6	55.8	57.8	43.0	38.3	48.9	57.2	35.3	93
413	19.5	16.3	19.6	20.5	26.0	36.3	54.0	51.0	50.3	41.8	46.2	58.0	36.6	96
4144	11.8	16.5	12.6	26.0	28.0	37.6	60.3	52.0	41.3	41.3	53.2	70.9	37.6	99
4130	11.6	14.7	10.6	25.6	43.5	42.8	58.0	53.5	38.5	41.8	52.4	65.2	38.2	100
47	13.8	14.0	23.5	23.1	27.1	40.6	62.5	62.3	44.3	41.8	50.0	59.2	38.5	101
430	20.2	20.5	27.0	33.8	32.0	38.8	52.9	61.1	42.8	34.3	46.5	57.4	38.9	102
46*	37.0	11.3	23.5	23.6	28.5	36.0	50.5	54.8	39.1	42.8	46.4	71.2	38.7	102
4123	23.3	14.6	30.1	21.8	26.7	32.0	62.3	62.6	45.6	35.6	53.9	58.0	38.9	102
419	37.5	18.6	22.8	22.5	23.1	41.6	58.0	52.8	55.1	40.8	56.7	63.0	41.0	109
B230*	--	18.8	34.5	26.0	21.5	38.6	51.5	66.6	46.3	48.6	47.7	61.5	42.0	110
B247*	--	33.5	31.4	63.8	57.0	65.3	57.0	65.3	49.8	44.8	51.4	70.0	49.5	130
Average	18.4	16.1	23.0	24.7	27.1	37.3	56.0	55.6	43.3	40.6	49.5	60.4	38.0	

*Strain isolated earlier in the program used as checks, not planted in same test with progeny 1944 and 1945.

TABLE 8. Diseased Floret or Ergot Content of Seed Produced by New Strains of Dallis Grass, 1943-1948

(Expressed in Per Cent by Weight)

Strain No.	Parent	Space-Planted Progeny				New Strains — Planted in Standard Rows								Per Cent of Group Average
	1943	1944		1945		1946		1947			1948		Average	
	Oct.	Aug.	Oct.	June	Aug.	Aug.	Oct.	June	Aug.	Oct.	June	Aug.	1943-48	
B230*	--	34.0	32.0	29.5	32.7	26.2	11.0	12.2	15.2	26.7	23.5	15.5	23.5	67
430	39.0	51.0	32.5	22.7	21.5	24.5	14.2	12.7	13.5	39.0	14.0	18.3	25.2	72
B247*	--	40.5	27.2	31.5	35.8	32.5	15.0	13.5	17.2	37.0	28.8	18.0	27.0	77
4123	31.5	67.7	39.2	42.0	22.1	37.5	15.0	15.7	25.2	45.2	26.8	26.5	32.9	94
419	23.3	67.2	53.2	39.0	34.7	34.7	16.0	24.5	20.7	41.5	24.5	22.0	33.4	95
413	60.5	71.0	51.1	42.5	25.5	31.7	11.0	20.5	16.5	39.0	27.0	18.5	34.6	99
46*	35.0	73.2	53.5	39.2	31.0	40.5	19.5	22.0	27.2	40.5	34.8	15.8	36.0	103
4123	46.0	64.5	47.0	46.5	25.5	41.2	19.2	22.7	26.7	41.7	26.8	22.8	35.9	103
4134	64.5	61.7	52.5	37.0	27.7	41.7	18.5	16.7	23.5	44.5	29.8	25.0	37.2	106
47	70.0	77.0	53.5	38.2	34.2	34.7	12.0	17.5	21.0	43.7	30.0	25.0	38.1	109
483	66.7	71.5	47.2	44.0	25.0	38.7	17.2	23.2	22.5	41.2	37.8	29.5	38.7	111
415	64.2	75.7	46.7	33.7	25.7	41.0	16.0	21.5	31.2	45.7	31.3	32.3	38.7	111
451	66.6	70.0	49.8	31.5	29.0	34.7	20.7	23.0	31.5	49.0	37.0	26.8	39.1	112
4144	69.0	73.0	62.4	36.0	34.0	36.2	15.0	27.5	31.0	41.7	29.8	13.3	39.1	112
4130	71.2	75.8	67.0	42.2	21.0	37.2	19.0	23.0	36.0	41.0	31.8	20.0	40.4	115
4131	56.5	66.0	65.2	49.2	25.0	38.5	25.0	17.5	26.0	46.2	37.5	29.0	40.1	115
Average	54.6	65.0	48.7	37.8	28.1	35.9	16.5	19.6	24.0	40.8	29.4	22.3	35.0	

*Strain isolated earlier in the program used as checks, not planted in same test with progeny 1944 and 1945.

used in others mentioned previously. The plants were planted in check rows in the field and the land cultivated. Seed was harvested in 1943, 1944, and 1945 where conditions permitted. Two harvests were made at all locations in 1943. In 1944 three were made at Hamburg and Calhoun and two at Baton Rouge. Three were made at Baton Rouge and Calhoun in 1945, but the test was not harvested in 1945 at Hamburg because volunteer seedlings of the year before obscured the original plants.

Seed was harvested by hand and brought to Baton Rouge for threshing, cleaning and analysis. The results of the analysis are given in Figures 5, 6, and 7. The results as illustrated consist of the averages for the nine strains at each location. Strain differences were evidence but they could not be shown in these diagrams. The results are in line with the experiments with the new-strains test shown above. Seasonal fluctuations at each location exerted a decided influence on the quality of seed produced. At Baton Rouge during the period of the test, the differences in seed quality for spring, summer, and fall harvest were less marked than at Hamburg or Calhoun. At Hamburg in 1943, the August harvest consisted of only 15.5 per cent pure seed, while in October of the same year 37.0 per cent of the total weight of the seed harvest was classed as viable. For 1944, June and October seed were both of better quality than those produced in August.

The results from the tests at Calhoun were somewhat more erratic than at either Hamburg or Baton Rouge. Seed harvested in August, 1943, had only 6 per cent of the total weight classed as viable. In October the same year about 9 per cent were pure seed. The differences between the inert fractions were most striking. In August, by far the larger portion, or about 75 per cent, of the inert weight was composed of empty florets. In October only 33.0 per cent of the inert weight was classed as empty florets but 59.0 per cent was infected by ergot. Throughout the seasons of 1944 and 1945 seed quality at Calhoun was considered as normal compared to other sections of the state, with June and October seed superior to August seed. August seed contained more diseased florets than that of either June or October. In each seed harvest reported, the samples analyzed represent the totals of seed produced. Only the foreign material was removed during the cleaning process.

Along with the results of the seed analyses the rainfall for the growing season is reported. The total rainfall during the growing season falls short of explaining the differences present. It has been observed, on the other hand, that favorable growing weather during the formative period does promote the production of better seed. At Calhoun during 1943 a deficiency of rainfall existed during the period from June through August. The rainfall in September was too late to affect the seed for October. It did appear to promote the development of ergot. On the other hand, at Hamburg in 1943 no measurable

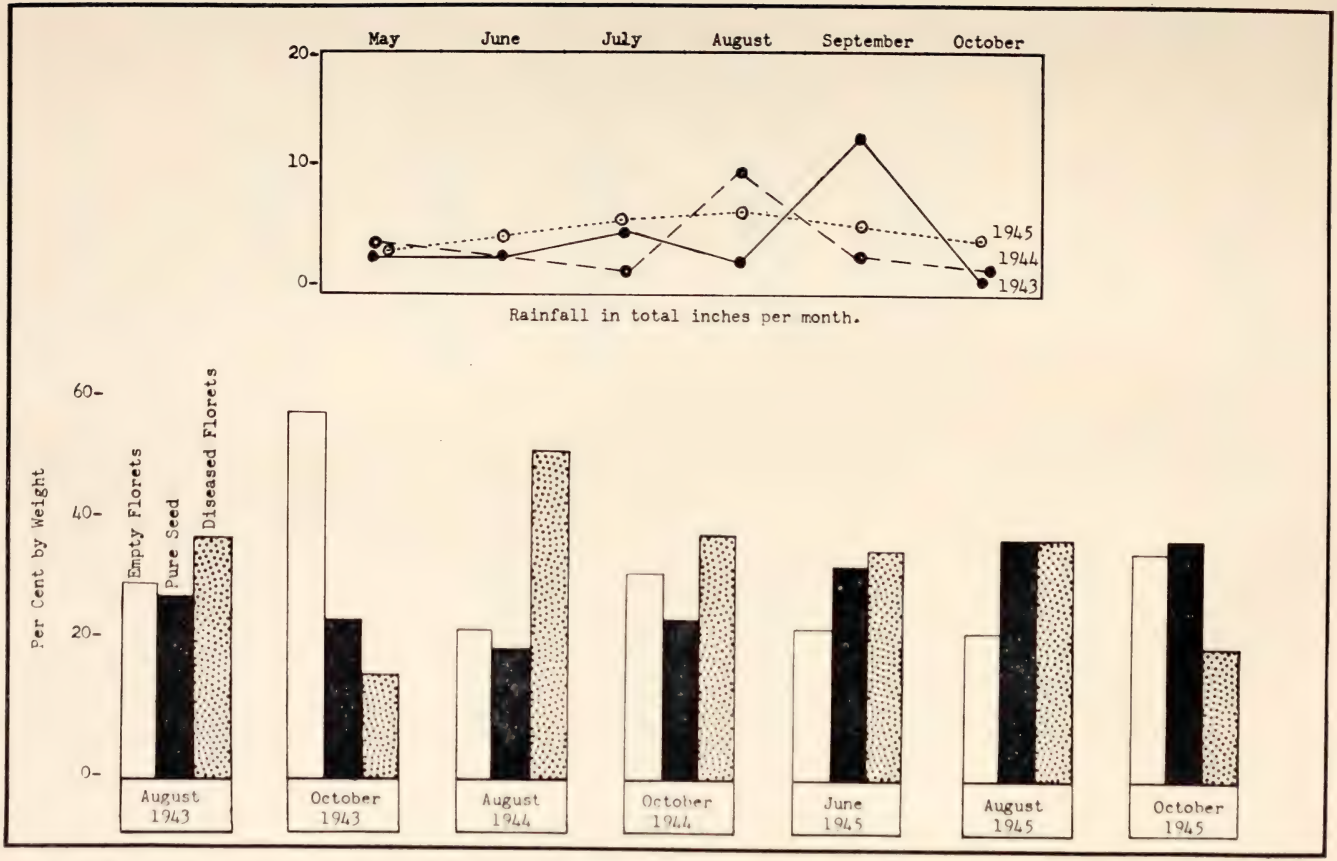


Fig. 5.—Seed quality as affected by seasonal differences. The average seed content of nine new strains grown on Olivier silt loam at Baton Rouge, La.

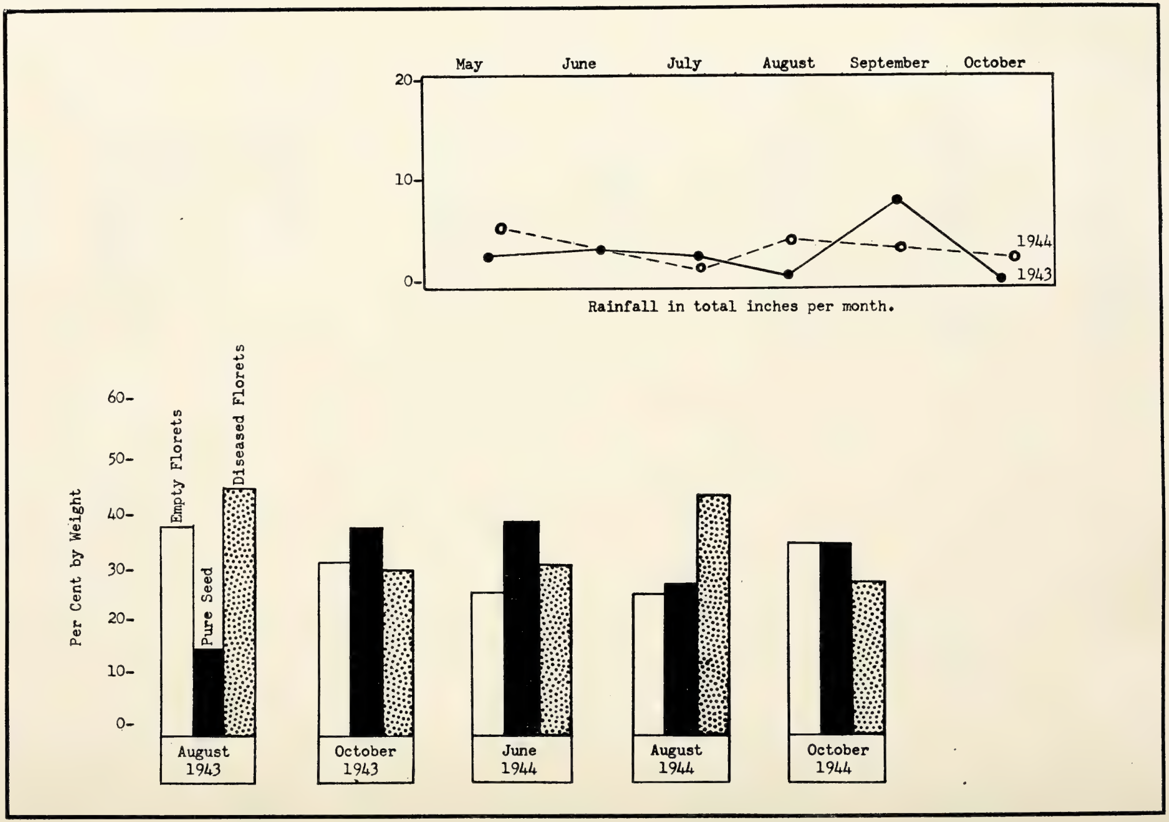


Fig. 6.—Seed quality as affected by seasonal differences. The average seed content of nine new strains grown on Miller clay loam at Hamburg, La.

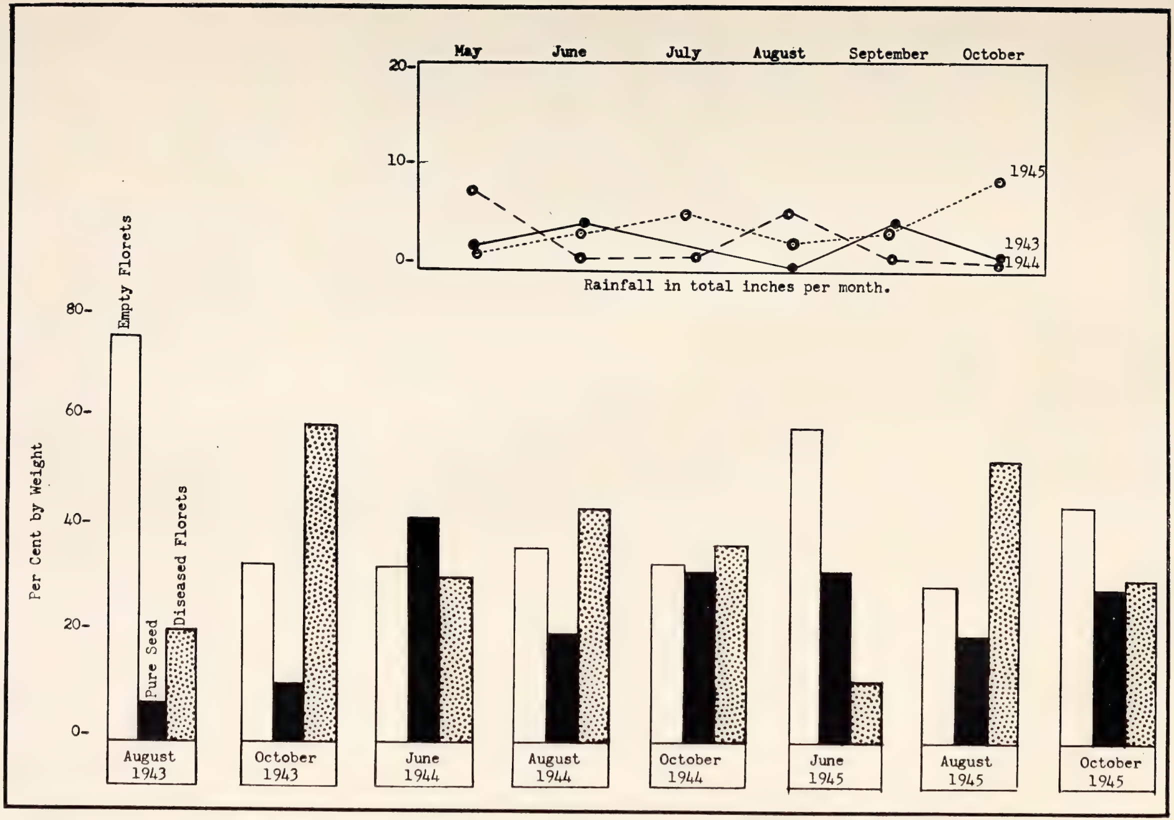


Fig. 7.—Seed quality as affected by seasonal differences. The average seed content of nine new strains grown on Ruston fine sandy loam at Calhoun, La.

precipitation was evident in the field where the test was planted from the time the plants were transplanted until the seed was harvested. Here the quality of seed was low. But the inert portion of the seed consisted of a large part of diseased florets.

Seed Formation in the Absence of Ergot

In view of the results obtained with seed formed under natural conditions, it would appear justifiable to list ergot as the principal hazard to the formation of seed in Dallis grass. In order to obtain further information regarding seed formation in Dallis grass, an experiment was planned where seed would be produced in the absence of ergot. Attempts have been made to protect plants from the disease in the field but without success. Conditions which kept the disease away usually prohibited normal development of the seed. During the fall of 1949 an experiment was undertaken to produce Dallis grass seed in the greenhouse. Soil was placed in the bed in November and plants from 11 different lines were transplanted thereto. After the plants had begun to develop vegetative growth the light period was extended by the use of fluorescent lights. Two 40-watt fluorescent tubes were suspended over the bed and allowed to remain lighted for a period of over 12 hours. They were turned on daily at 8 a.m. and turned off at

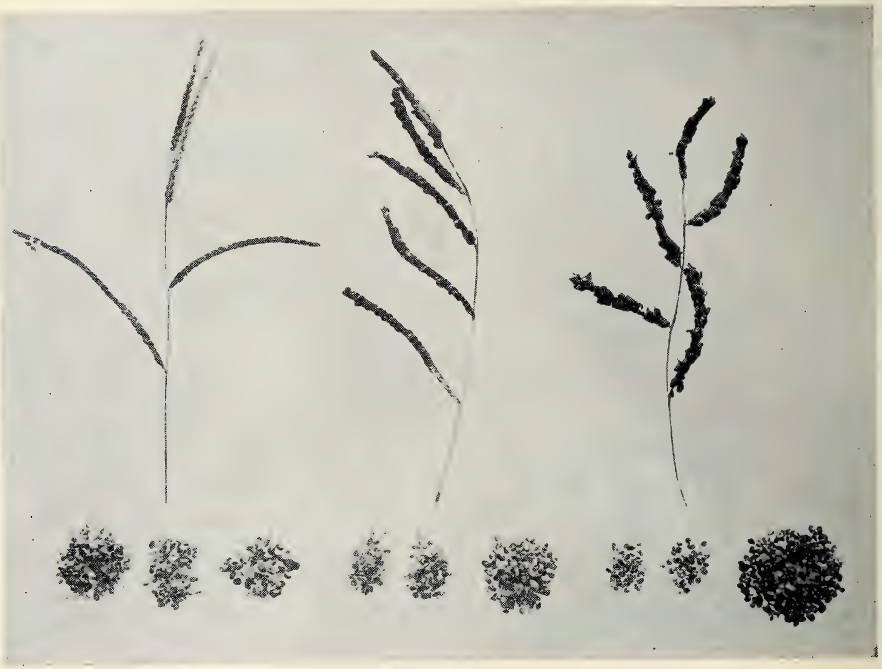


Fig. 8.—Dallis grass seed heads showing different degrees of disease infection. Left to right: light, medium and severe infection. The seeds shown below illustrate the portion of empty florets, pure seed and diseased florets in each head. *Photographed by E. C. Tims.*

9 p.m. Normal heads had formed by February 1 and the seed were mature by March 1.

Seed heads were cut from the plants March 1, April 15, and July 1. Heads were packeted in separate envelopes and later the filled and empty florets were separated from each head and counted. The results of the counts are given in Table 9.

TABLE 9. Seed Formation on Different Lines of Dallis Grass Grown in Greenhouse Free of Ergot (Per Cent by Count)

	Line Number											
DATE	1	2	3	4	5	6	7	8	9	10	11	Average
March 1st	7.7	2.3	14.2	4.7	12.5	2.3	8.5	12.6	12.8	16.7	5.9	9.1
April 15th	15.6	2.3	18.5	8.3	17.1	8.2	24.2	26.0	19.6	9.9	13.9	14.9
July 1st	6.4	.5	8.1	4.2	9.0	11.5	11.4	12.7	5.7	4.5	9.1	7.6
Average	9.9	1.7	13.6	5.7	12.9	7.3	14.7	17.1	12.7	10.4	9.6	10.5

It is evident from the results that factors other than disease may act in lowering the number of seed set. The fact that more seed were set for April 15 harvest than for either March or July is also significant. It would appear that the more favorable conditions for plant growth inside the greenhouse in March and April likewise affected the number of seed set during that time. Seed harvested March 1 formed during the months of January and February. The lower per cent of seed formed for July 1 and March 1 is apt to be due to less favorable conditions for growth during the seed forming period. The greenhouse apparently was not regulated properly for the formation of seed after the grass headed.

It is apparent from this experiment that a difference exists among the lines for the production of viable seed. Lines 2, 4, and 6 were included in the test for the reason that they were below the average in pure seed formation in the field in previous years. The differences between these lines and line 8, for example, may be observed in the table. Doubtless much of this variation can be attributed to an inherent tendency in the lines included. Line 2 set seed in only 1.7 per cent of the florets while line 8 filled 17.1 per cent of the florets in the same environment, as the average for three harvests shows. Ergot had no effect on the amount of seed set since the disease did not appear inside the greenhouse at any time during this experiment.

SECTION II

Seed Production with Dallis Grass

Experiments with Dallis grass breeding have provided certain information which should be helpful to farmers who wish to produce seed of Dallis grass as a part of the farm business. The value of such data as applied to seed production on large fields is of course limited. By far the larger part of the information has been collected from small plots. During the past four or five years seed increase blocks of from two to six acres in size have been grown on the Experiment Station farm at Baton Rouge. These blocks have been tended for seed production only, and a certain amount of experience gained might not be entirely usable in North Louisiana or other sections of the South.

Imports from Australia have been, and still are, the principal source of high quality planting seed for pastures of the South. Table 10 gives the total quantity of seed imported by years, since 1921.

TABLE 10. Imports of Dallis Grass Seed for the Years Beginning July 1, 1921-1949*

Year	Pounds	Year	Pounds	Year	Pounds
1921	11,600	1931	19,400	1941	729,200
1922	9,500	1932	18,200	1942	258,800
1923	6,300	1933	6,300	1943	653,500
1924	29,400	1934	42,300	1944	566,100
1925	1,000	1935	28,500	1945	249,100
1926	1,000	1936	71,500	1946	575,400
1927	15,600	1937	108,100	1947	1,185,200
1928	12,400	1938	144,300	1948	1,701,100
1929	26,000	1939	106,400	1949	997,600
1930	37,500	1940	313,400		

*These data were supplied by Dr. G. C. Edler, In Charge of Seed Section, Division of Field Crop Statistics, Bureau of Agricultural Economics, U.S.D.A. They were furnished to him by the Grain Branch of the Production and Marketing Administration, U.S.D.A.

Seed produced in the United States prior to about 1934 was negligible insofar as the records show. Since then the supply of domestic seed has increased somewhat, but still the supplies used for planting amount to only a fractional part of the quantity imported. As mentioned before, the quality of domestic seed has been very low. The content of viable seed has on occasions been so low that commercial seedsmen were reluctant to handle domestic seed at any price.

Planting Grass for Seed Production

Dallis grass, for seed production, should be considered as a crop and plans should be made in the beginning to handle it as such. Dallis grass grows well on a wide range of soil types in Louisiana if fertilizers are provided to amend any soil deficiencies present. It is thought, however, that the heavier soil types are best for the production of quality seed. Dallis grass has been found to give good response to fertilizer whenever the soils are found deficient. Fertilizer recommendations for various soil types may be obtained by consulting the Parish Agricultural Agent.

For the production of Dallis grass seed it is necessary to have available adequate facilities for harvesting and curing the seed. When the seed is ready for harvesting it is well not to delay the operation. Adverse weather conditions may set in and cause much damage to the crop. The purchase of cleaning machinery may be advisable if the quantity of seed produced justifies it; otherwise, the grower should contact the nearest commercial seed cleaning plant.

Planting the Seed

For best results in establishing a stand of Dallis grass for seed production, experiments have demonstrated that the grass should be planted in drills of standard width rows. Forty to forty-two inch rows have been found to work well with the planting of increase fields at Baton Rouge. Grass seed may be planted with any good corn or cotton planter if the bottom of the planter box is tight enough to prevent the loss of seed around the plates. Plates may be either those used in duplex hoppers for corn and beans or a small-seeded soybean plate used in the ordinary corn or cottonseed hopper. With either type, the rate of seeding need not be over five pounds per acre.

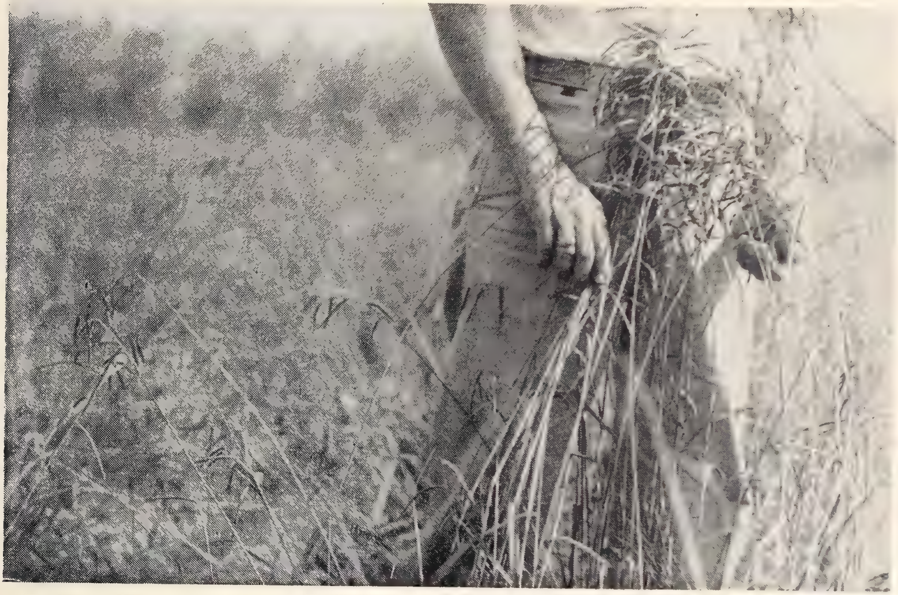


Fig. 9. A reasonable explanation for high seed production with Dallis grass planted in rows. The single plant illustrated was planted in May, photographed the following August. The grass was fertilized and cultivated to keep the weeds down.

The land should be well prepared by breaking, disking, and harrowing. These operations are essential for preparing the land in such a manner that the soil surface is free of dips. If the land is subject to erosion to the extent that terracing is required, of course the rows should be contoured. On such land it may be desirable to plant on low beds to prevent erosion as much as possible. It is also essential that the seedbed be firm before planting, whether the seed is planted on beds or on the level. Freshly plowed land that is fairly well pulverized may be adequately firmed by running the cultipacker over it.

Planting should be done as early in the spring as practical after the danger of frost has past. If it is practical, the seed should be planted on the level with no beds. On land where beds may be necessary to prevent excessive erosion they should be no higher than is required for that purpose. The seed may be planted with the planter with the depth of covering set as shallow as possible so that the seed are covered. In no case should seed be covered more than one-half inch. Early planting is best for the prevention of serious weed problems. It is well known that weed and crab grass seed are always present, especially in soil which has been planted to row crops for a few years. Early planting of Dallis grass will aid in getting the seedlings off ahead of such weeds. Because of the weed problem it is best not to apply fertilizer high in nitrogen before planting. As soon as the plants are up enough to be seen plainly by the tractor driver, the field should be cultivated to prevent growth in the middles. Weed growth may be kept down in the drills by mowing, and mowing should be repeated as often as the weeds reach sufficient height to be clipped by a mower.

When the grass has become established, an application of 30 to 45 pounds of nitrogen per acre will pay off in increased yields of better quality seed. It is best to continue to cultivate the middles lightly until the grass begins heading. This will keep the weeds down until the grass becomes sufficiently large to compete. Unless cultivation is anticipated, row planting may not be practical. The space between rows may not be filled in by volunteer seedlings nearly as well if sod forms in the middles. Cultivation provides a well-prepared seedbed for the seed which shatter from the rows. If the ground has become packed by rain, a light cultivation in the middles after the first seed harvest will help to give the shattered seed a better chance of germinating. This is the source of young plants which are to fill in the middles by the end of the first season.

After the first seed crop is harvested, a second top-dressing with nitrogen fertilizer will give considerable increase in production of the succeeding seed crop. The fall crop is often of higher quality than the summer crop because of less infection by ergot. Any practice which will tend to give better yields of the late crop will help to improve average quality of the seed. Care should be exercised to avoid using for seed production land which may contain excessive quantities of noxious weeds. In Louisiana, Johnson grass and certain species of dock (**Rumex spp.**) are two classes of weeds which are most troublesome.

The usual method of planting Dallis grass is, of course, broadcast. In 1946 experiments were set up to compare seed production from the usual method of seeding with that of planting in drills 42 inches apart. The seeding rates were: broadcast, 25 pounds per acre; drills, 5 pounds per acre. Fertilizer was applied at the same rate but it was applied broadcast and worked into the soil on the plots seeded broadcast and in bands by the drill on row plots.

Results in Table 11 indicate a 25 per cent increase in seed production for row plots from the August harvest, and for October the yield from rows was double that from broadcast plots. The increase in seed production from row plantings over broadcast is in line with experiments with other grass species. A number of workers from other states report similar results with other grasses. Row planting is recommended with Dallis grass as a method for establishing seed fields. It is more desirable when using seed of new strains, because the seed may be planted over a greater acreage, which obviously will give more rapid increase in seed.

TABLE 11. Seed Production with Dallis Grass, Broadcast Seeding vs. Row Planting, 1946
(Pounds Per Acre)

Date Harvested	Row Plots	Broadcast	Difference
August	204.2	156.7	49.5
October	96.9	41.7	55.2

The length of time in which a field may be maintained in profitable seed production has not been determined. It is thought, however, that probably the land should be broken at least every three years. Dallis grass sods have been thoroughly broken and disked after the grass has become well established without destroying the stand. Lime and phosphate fertilizer were applied on the grass sod in October at the time of the breaking and disking. The grass came back the following spring and produced a good crop of seed by June 15.

Harvesting Seed

An effort has been made to obtain definite information regarding the methods used in growing, harvesting and processing seed in Australia. Up to now only one report has been received. A brief report of the methods used in harvesting and cleaning the seed was supplied in the form of a printed circular from W. Secombe, Coff's Harbour, New South Wales, Australia.[1] The methods were described by a news reporter in the Pastorialist Review. Essentially, they were as follows:

> "Each worker is provided with a dish, which he places on the ground in front of him; seizing an arm full of grass he bends it over the dish; and after a couple of shakes passes his hands lightly over the seed, dislodging the ripe seed and leaving the unripe on the stalk. An apron in front of him prevents any seed from falling on the ground. He works his way in this fashion across the field, pushing the dish with his feet. A good picker can gather up to 100 pounds a day in this manner, and there is always a keen rivalry amongst the men as to who will have the biggest talley at the end of the day. . ."

---

[1] Submitted by G. C. Edler, In Charge of Seed Section, Div. Field Crops Statistics, Bureau of Agricultural Economics, U.S.D.A.

> "After inspecting various fields we paid a visit to the drying ground and barn. Here we found a large enclosure surrounded with wire netting and spread with hessian on which seed is spread to dry. After being thoroughly dried, it is taken to the barn and sifted, all stalks, husks, etc. being removed It is then packed in corn sacks, branded and weighed. . ."

This was dated 1937. Although this method of harvesting grass seed seems rather laborous, there are certain phases which might be considered as worthy of adoption with seed production in Louisiana. Experiments show that Dallis grass seed heads (Table 9) often contain a large percentage of light seed or empty florets. Obviously an increase in light chaffy material will decrease the percentage of pure seed. Matured seed are not difficult to thresh and remove from the heads. Empty florets often tend to remain attached to the seed heads, especially those on immature heads. There may be a tendency with those inexperienced with grass seed harvesting to set the threshing machine so as to expel the straw clean of seed, especially free of unthreshed heads. Most combines may be adjusted in such manner that only the mature seed will be threshed, permitting many of the green heads to pass through intact. Better seed samples will result if the immature heads are left on the ground in the field. Also the air blast may be adjusted so as to remove a portion of the light, empty florets without losing many filled seed. This is possible because the weight of filled seed individually is roughly twice that of the empty floret. All of the

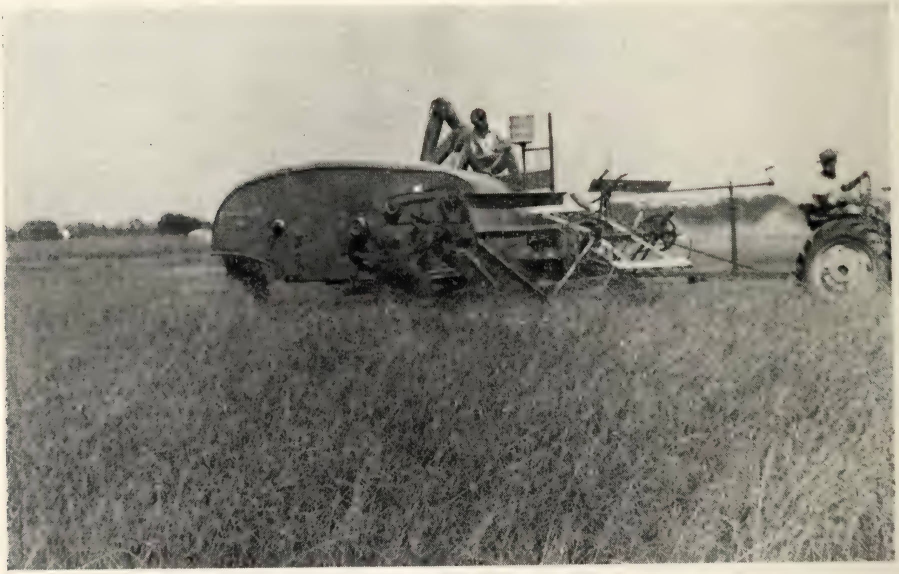


Fig. 10.—Harvesting seed of new strains of grass September 1, 1950. This was the third crop harvested from this block during the season.

light material will not be removed from the seed during the harvesting process but much of it may be. It is no cause for alarm if a portion of the lighter material (empty florets) is fanned out. Only experience can enable an operator to give the harvesting machine the proper adjustment. It is well to catch samples of the material as it is blown over the screens and examine the content. Filled seed are easily detected by pressing the individual florets. Seed are usually flinty and will not collapse when pressed with a pointed object such as a lead pencil.

Dallis grass seed has been successfully harvested by two methods: (1) threshed directly from standing grass and (2) from grass mowed and allowed to dry on the ground in the swath. There are advantages and disadvantages with both methods. Seed combined directly from standing grass is desirable from the standpoint of saving the seed, for the reason that it saves time. A field of grass may be combined in about the same period of time required to mow it. This time element is often important where summer showers interfere with operations. Often especially in south Louisiana, the occurrence of showers during the harvesting period is a serious hazard to curing forage of any sort. Heavy showers on grass seed in the swath may cause a large portion of the pure seed to shatter, resulting in serious losses. On the other hand, seed dried in the swath may be stored immediately after harvesting without danger of heating.

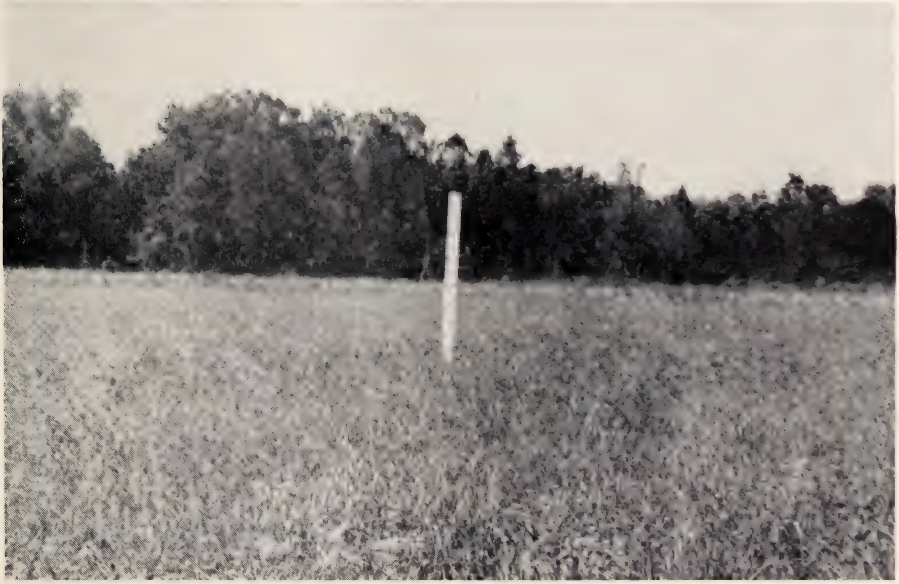


Fig. 11.—Fall seed crops of Dallis grass seed while often not as heavy as summer crops may have a high percentage of pure seed. This crop was harvested November 15, 1949. After cleaning, the seed tested around 80 per cent pure seed.

Seed combined from standing grass will contain from 20 to 40 per cent moisture. Consequently, caution must be exercised to prevent spoiling through heating. Such seed may over-heat if kept in bulk for as long as 30 minutes; in some instances in less time. To prevent heating it is necessary to spread the seed on a floor or tarpaulin at a depth of not more than four or five inches. Seed should be stirred thor-

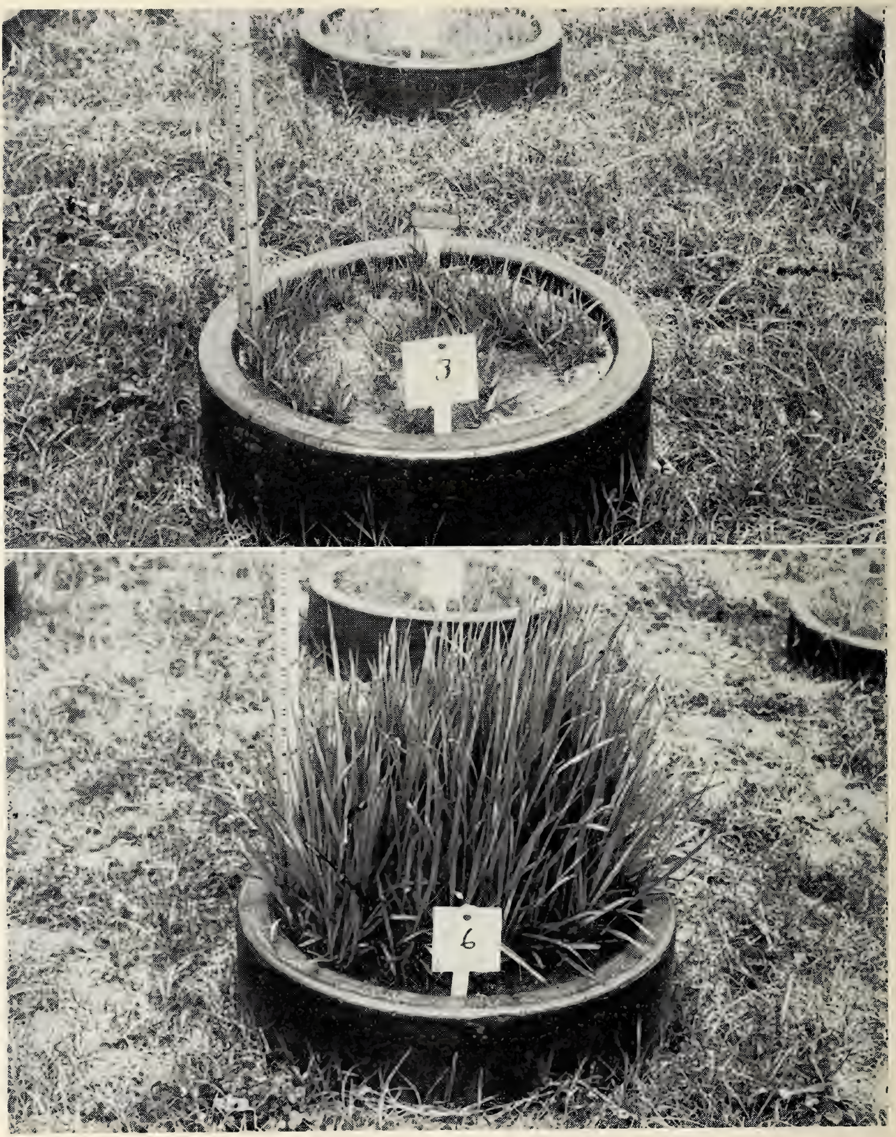


Fig. 12.—Dallis grass responds to fertilizer. No. 3—Ruston Fine sandy loam; no fertilizer. No. 6—Same soil, 400 pounds 4-12-8 fertilizer applied at planting, April 15. Photographed June 25.

oughly every two or three hours during the first day and three or four times a day thereafter. Depending on the weather, the seed should be ready to sack in from three to five days. Naturally the drying process is slower during periods of high humidity than when the air is dry.

Artificial drying will be of value in processing seed that was harvested by combining standing grass. Driers are being used successfully with seed of other crops, and Dallis grass seed should not be difficult to dry. The seeds are small and the harvested material gives up the moisture readily when subjected to blasts of heated air. Preliminary experiments conducted in the laboratory in 1943 showed that the seed were not injured when subjected to temperatures as high as 135 degrees Fahrenheit for several hours. The use of artificial driers appears to be one way to help in improving the quality of Dallis grass seed. It should be kept in mind that a seed drier can only preserve the quality present. It will add nothing to the seed except dryness. If artificial driers are used, extra floor space should be provided for spreading the seed directly from the harvesting field. The period during the time the seed remain in bulk just after harvesting directly from the stands is critical. Seed should be placed immediately in the drier or spread to dry very soon. At Baton Rouge the moisture content of seed at harvest time is usually higher in the summer. This is apparently due to the excess honeydew which is usually more prevalent during July and August. Honeydew is exudate from developing ergot.

Grass cured in the swath does not present the problem of heating and spoiling after it is threshed. As mentioned before, however, there is always the possibility of losing the seed due to rain after mowing. With extended periods of dry weather there may be a temptation to let the grass remain in the swath several days longer than necessary. It is important that the seed be threshed as soon as the grass is cured sufficiently for hay. Extended exposure to dew and sunshine may cause a loss of the matured seed by shattering. At least much more of the immature seed tend to be threshed from overcured straw, which results in seed with a high content of inert material.

Cleaning Seed

After the seed is harvested and cured properly the job of preparing the best quality seed for the market is only half completed. It is very important that it should be cleaned of all foreign material. Also, as much of the inert material should be removed as is physically possible. Through the use of the available cleaning machinery it is possible to add considerably to the appearance and value of the seed after it is harvested and dried. Experience gained by handling Dallis grass seed at Baton Rouge suggests that cleaning should not be undertaken too soon after harvesting. Clean seed may tend to overheat at a lower moisture content than seed mixed with foreign material. The foreign material which is left in the seed by the field harvester holds the seed apart and helps to prevent spoilage. Of course, if seed is dried to a safe moisture content for storage, either by letting it dry in the swath or by artificial drying, it may be cleaned and sacked as soon afterwards as is convenient. Where drying is not completed as with spreading on floors or tarpaulins it would be risky to clean seed of all foreign material and sack for storage before it has had ample time to dry out as much as possible.

Seed should not be offered for sale before it is cleaned. For the farmer with several hundred to a few thousand pounds of seed to clean, there are commercial cleaning plants within trucking distance of most anyone in the state. For adequately cleaning Dallis grass seed, two types of cleaners are considered as essential: first, the indented cylinder seed separator and second, the cleaners which utilize the screens and air blast in combination. The first type removes the pieces of straw and other material larger than the seed, while the screens and air blast remove small weed seeds, empty chaffy seed, dust and dirt.

How Long will Dallis Grass Seed Retain Viability in Storage?

The length of time that Dallis grass seed will retain viability in storage undoubtedly is very important and will depend upon a number of factors. Among them perhaps the most important are temperature and humidity of the storage bin or house. Seed was stored in the laboratory in glass enclosed shelves for 6 months, 18 months, 30 months, and 42 months. Germination tests were made during the winter of 1949. Seed had been packaged in Kraft paper bags in small lots. The results are as follows:

Storage Period	Germination Per Cent
6 months	70.0
18 months	32.0
30 months	6.0
42 months	0.0

The seeds were kept in the germinator 35 days. The temperature of the germinator was alternating between 20°C for 12 hours and 35°C for 12 hours. The seed were treated with 0.1 per cent solution of potassium nitrate at the time they were placed in the germinator. The substratum used was two layers of filter paper in petri dishes. From these results it would appear to be unsafe to plant seed more than two years old. No doubt, however, storage at lower temperatures would lengthen the life span. Australian seed harvested in January and February is usually as much as 12 months in storage before being planted in the United States.

Frequency of Harvesting Seed

If a field is utilized entirely for seed production, two, three, and sometimes four seed crops may be harvested during a single growing season. Repeated harvests as the seed mature throughout the grow-

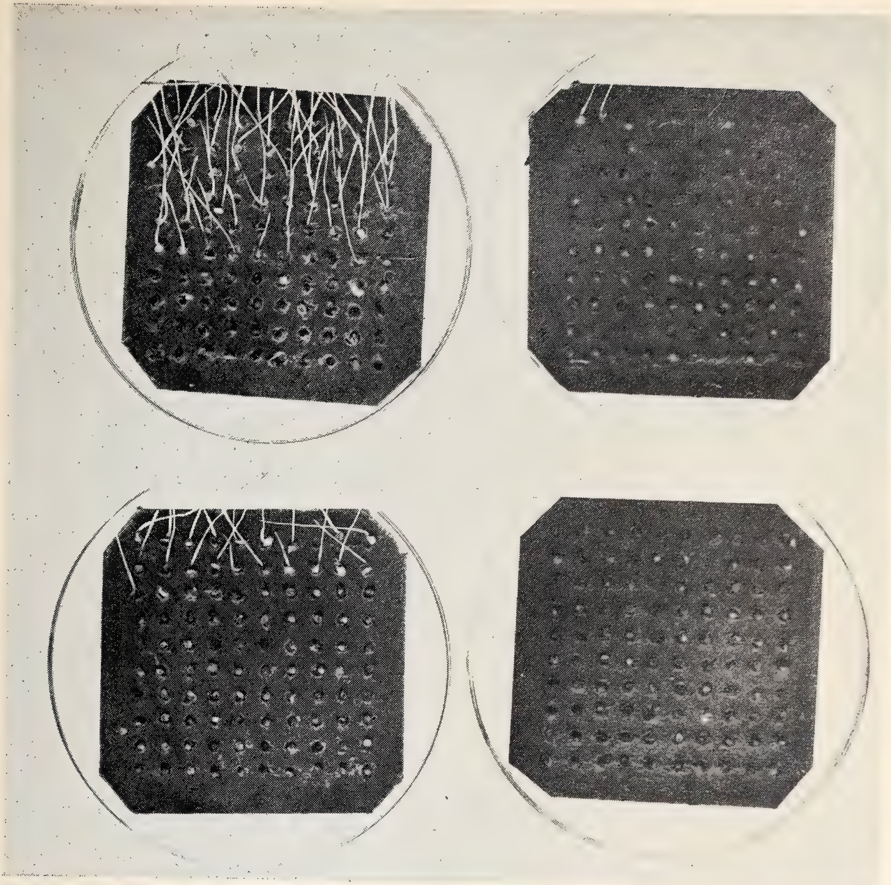


Fig. 13.—The viability of Dallis grass seeds deteriorates rapidly after one year in storage. Counts made after one week in germinator. Upper left — Six months in storage; lower left — Eighteen months in storage; upper right — Thirty months in storage; lower right — Forty-two months in storage. The seed were stored in Kraft paper bags in the laboratory. *Photographed by E. C. Tims.*

ing season will fully utilize the production potential. As indicated in the new-strains test, seed may be harvested in June, again about six weeks later, and a third time within six to eight weeks thereafter. Such operation will be dependent upon the prevailing weather conditions. There are periods during the growing season when the fields are too wet for weeks at a time to operate a combine. Naturally such delays cause losses in seed production. The interval of time between seed harvests will also be dependent upon the treatment given the seed field. For example, if the forage is not so thick as to affect the development of new shoots, and weed growth is not a problem, it should not be necessary to mow the field after the seed is harvested. In such fields the succeeding seed harvests may be made after four to five weeks. If it is necessary to mow the field for weed control, the interval between seed harvests may be extended to six or eight weeks. The difference in interval between harvests is due to the stubble height. When the seed are combined directly, the straw is clipped above the basal leaves. From these plants new seed heads arise within a short time. Many heads in the early phase of development are not cut. In fields which are closely mowed, the major part of the new growth must arise from the root stocks. Under the latter treatment the interval between seed harvests would be increased by two weeks or more.

How to Determine When Seed Fields are Ready For Harvesting

Maturity in Dallis grass seed can be detected by the color of the heads and straw. Usually the heads are of a light brown color when seed is ready for harvest. The straw at such time will be yellowish, somewhat like small grain. The difference between small grain, such as oats, and Dallis grass is that oats are uniform in maturity. The only time during the year in which the seed heads of Dallis grass are uniform in maturity is late in the fall. At other times during the growing season it is unlikely that there will be more than 60 to 75 per cent of the seed heads ripe. During the spring and summer, seed harvests should be made when 60 to 75 per cent of the heads are ripe. If the operation is delayed the ripe heads may be lost. The green heads will not thresh if the combine is properly adjusted. On the other hand, it is just as important not to harvest when there is too large a portion of green heads present.

Pastures and Seed Production

A system may be worked out whereby a program of Dallis grass seed production can be carried on in conjunction with pastures for grazing. This will involve an extended period of rotation of livestock in pastures. Since Dallis grass produces seed in central and south Louisiana from May until October, certain fields of grass might be utilized for pasture while others are growing seed. When seed is harvested the livestock might be allowed on that field while the other is producing a crop of seed. Such a program has been in practice on some farms in Louisiana for a number of years. Mixed clover and grass might be used for spring pasture. Spring seed fields should have only grass if a grass seed crop is expected in June. Clover usually prevents proper development of grass until after June 1. Two seed crops would be possible on the summer pasture, while only a summer seed crop could be harvested from the field pastured during the spring. The acreage for such a program would be twice that needed for pasture alone.

It is impractical both from the standpoint of pasture management and seed production to graze livestock and harvest seed from one field during the same period. Cattle should not be allowed in fields used for seed after the grass is heading. Pastures should not be allowed to go to seed while being grazed. Ergot poisoning occurs only in pastures that are allowed to go to seed.

Seeding Rates and Quality

In seeding Dallis grass the basic principle is very similar to that with corn. The seeding rate should be such as to provide maximum forage production. Since the quality of seed is variable, at least in domestic seed, the problem of adjusting the rate of seeding becomes more complicated. Quality with Dallis grass seed is measured by two factors, per cent purity and per cent germination. The product of the two gives what is known as the **pure live seed factor.** This factor, while not entirely representative of the planting value, is a workable estimate of quality. Of course, this factor gives nothing definite on the planting rate except in a general way by comparison.

Table 12 is presented for the purpose of providing assistance to those who may wish to determine the planting rate, in pounds per acre, of the seed at hand. By the use of this information the planting rate may be adjusted to the number of pounds of seed necessary to provide 10 live seed per square foot when sown over an acre of land. With any lot of seed, if the purity and germination are known, the seeding rates may be easily estimated.

TABLE 12. Rates of Planting Dallis Grass Seed, in Pounds per Acre, at Varying Percentages of Purity and Germination*

Per Cent Purity	Per Cent Germination									
	25	30	35	40	45	50	55	65	75	85
85	9.3	7.8	6.7	5.8	5.2	4.7	4.2	3.6	3.1	2.7
75	10.6	8.8	7.5	6.6	5.9	5.3	4.8	4.1	3.5	3.1
65	12.2	10.2	8.7	7.6	6.8	6.1	5.5	4.7	4.1	3.5
55	14.4	12.0	10.1	9.0	8.0	7.2	6.5	5.5	4.8	4.2
50	15.8	13.2	11.3	9.9	8.8	7.9	7.2	6.1	5.3	4.7
45	17.6	14.7	12.6	11.0	9.8	8.8	8.0	6.8	5.9	5.2
40	19.8	16.5	14.1	12.4	11.0	9.9	9.0	7.6	6.6	5.8
35	22.6	18.9	16.2	14.1	12.6	11.3	10.3	8.7	7.5	6.7
30	26.4	22.0	18.9	16.5	14.7	13.2	12.0	10.2	8.8	7.8
25	31.7	26.4	22.6	19.8	17.6	15.8	14.4	12.2	10.6	9.3
20	39.6	33.0	28.3	24.8	22.0	19.8	18.0	15.2	13.2	11.6
15	52.8	44.0	37.7	33.0	29.3	26.4	24.0	20.3	17.6	15.5
10	79.2	66.0	56.6	49.5	44.0	39.6	36.0	30.5	26.4	23.3

*The rates are based on the amount required to supply 10 live seed per square foot of area.

From the table it is possible to use the purity per cent together with the germination and determine the amount of seed for seeding an acre of land. For low quality seed, purity 20 per cent and germination 50 per cent, about 20 pounds is needed to plant an acre. With higher quality seed, purity 65 per cent and germination 75 per cent, only four pounds is required. A question may arise concerning the possibility of seeding only four pounds of Dallis seed to an acre. Considering that the accepted weight per bushel is 15 pounds, four pounds is over a peck in volume. It should not be difficult to distribute this amount over an acre even with ordinary hand machines.

SUMMARY

1. A program of Dallis grass breeding has resulted in the isolation of strains which are substantial improvements over native grass for the production of viable seed. Strains B230 and 430 have produced seed that, in purity, were 27 and 32 per cent above the average, respectively. A major portion of the pure seed increase may be accounted for in the decrease in diseased seed content. The diseased seed content with these two strains, B230 and 430, was 67 and 72 per cent of the average, respectively. These results were taken from tests conducted over a period of five years.

2. Observations within progenies lead to the belief that this species is somewhat more variable than indicated by other workers. This is based on the fact that nearly one-fourth of the progenies included showed to be segregating for plant type. Examples of segregation are illustrated in photographs of three unrelated progenies (Figure 1).

3. Dallis grass seed produced under different climatic and soil conditions may vary widely in quality. For normal seed development soil moisture is often a limiting factor. Excessively wet soils as well as extended droughts are detrimental to seed formation. Soils which tend to be droughty may not be consistent in producing seed of normal pure seed content even with low disease infection.

4. Generally, ergot reaches the peak of infection during the summer months in Louisiana. This accounts for the low quality of domestic seed since most seed are harvested from summer crops.

5. Experimental results suggest certain cultural practices for the production of seed of improved quality. For seed, plant the grass as a crop and treat it as such. This entails planting only Dallis grass on the land and employing such cultural practices as may be necessary to keep weeds down and to promote optimum growth and development of the grass plants.

6. The new strains will influence quality of the seed produced, provided good cultural practices accompany their use.

7. In the absence of disease infection in the greenhouse, seed formation was found to be variable between lines. Certain lines tend to be more fertile or produce more viable seed per 100 florets than others.

8. Seed of Dallis grass are considered as short-lived. Seed stored in the laboratory lost half the viability the second year and four-fifths of the remainder the next year. Seed more than three years in storage did not germinate.

9. Seed fields utilized entirely for seed production may be harvested as many as four times during a growing season in south Louisiana.

10. Seeding rates with Dallis grass should be based upon the purity and germination of the seed as determined by a licensed seed analyst. The quantity of seed required to supply 10 live seed per square foot when sown on an acre is used as the base.

LOUISIANA BULLETIN NO. 450 MARCH, 1951

Quality of Ginning Services in Relation to Cost of Ginning in South Louisiana, 1948 and 1949

By

JAMES F. HUDSON AND ROBERT A. MONTGOMERY

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, DIRECTOR

TABLE OF CONTENTS

PAGE

INTRODUCTION 1
OBJECTIVES AND IMPORTANCE OF STUDY 2
METHOD AND SCOPE OF STUDY 3
THE GINNING INDUSTRY IN SOUTH LOUISIANA 4
ROUGH GIN PREPARATION 5
THE RELATIONSHIP OF CONDITION OF SEED COTTON, GIN MACHINERY AND OPERATING PRACTICES TO QUALITY OF GINNING 6
  Moisture Conditions of Seed Cotton 7
  Foreign Matter Content and Removal 12
  Grade and Value of Lint 18
  Lint Moisture as Related to Monetary Returns to Farmers 21
  Preventing Gin Damage to Cotton 24
COST OF GINNING 27
  Items of Cost 28
  Investment in Ginning Industry 30
  Comparative Cost of Ginning by Gin Groups 32
  Fixed and Operating Costs 38
    Fixed costs 38
    Operating costs 39
  Effect of Volume and Size of Plant on Ginning Costs 40
GINNING REVENUE 42
CONCLUSIONS AND RECOMMENDATIONS 43

LIST OF TABLES

TABLE

1 The average grade and staple length of cotton produced in District No. 4, South Louisiana, and the proportion reduced in grade due to rough gin preparation, 1941 through 1949 2
2 Total number of gins; number equipped with driers and specified doffing equipment, South Louisiana, seasons 1935, 1940 and 1945 5

3 The percentage of cotton arriving at gins with 12 per cent or less moisture in the seed cotton and the per cent of ginnings with lint moisture content of 6.9 per cent or less, by gin groups, South Louisiana, seasons of 1948 and 1949 8

4 Seed cotton moisture content and removal, and lint moisture content, by gin groups, for specified ginning periods and for the season, South Louisiana, season 1948 9

5 Seed cotton moisture content and removal, and lint moisture content, by gin groups, for specified ginning periods and for the season, South Louisiana, season 1949 10

6 Foreign matter content and differences of seed cotton before conditioning and cleaning that produced SM, M, and SLM lint grades after ginning on standard and substandard gins, South Louisiana, season 1948 13

7 Foreign matter content and differences of seed cotton before conditioning and cleaning that produced SM, M, and SLM lint grades after ginning on standard gins, substandard gins with driers and substandard gins without driers, South Louisiana, season 1949 13

8 The average foreign matter content of seed cotton before and after cleaning that produced specified lint grades after being ginned on standard and substandard gins, South Louisiana, season 1948 14

9 Seed cotton foreign matter content and removal by gin groups and ginning periods, South Louisiana, season 1948 16

10 Seed cotton foreign matter content and removal, by gin groups and ginning periods. South Louisiana, season 1949 17

11 Quality of ginning, by gin groups and ginning periods, as measured by lint classification . staple length, and preparation, South Louisiana. season 1948 19

12 Quality of ginning, by gin groups and ginning periods, as measured by lint classification, staple length, and preparation, South Louisiana, season 1949 20

13 The relationship of lint moisture content to rough gin preparation, turnout, and monetary returns to the producer, by gin groups and ginning periods, South Louisiana, season 1949 22

14 The effect of drying temperature on staple length, South Louisiana, seasons of 1948 and 1949 23

15 Estimated average loss in value per bale resulting from rough gin preparation for 11 crop reporting gins, South Louisiana, season 1949 24

16 Stratification of gins for cost study, by gin groups, and number of stands per gin, South Louisiana, seasons of 1948 and 1949 27

17 Replacement value per gin, replacement value per gin stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949 29

18 Present value per gin, present value per gin stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949 31

19 Replacement value and present value per bale ginned, by gin groups, South Louisiana, seasons of 1948 and 1949 32

20 Distribution of ginning costs by gin groups, South Louisiana, season 1948-49 33

21 Distribution of ginning costs by gin groups, South Louisiana, season 1949-50 34

22 Total ginning cost per bale, operating cost per bale, fixed cost per bale and number of bales ginned per stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949 36

23 Total cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949 38

24 Total cost per bale, by gin groups and volume per gin, South Louisiana, seasons of 1948 and 1949 38

25 Fixed cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949 39

26 Operating cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949 40

27 Operating cost per bale, fixed cost per bale and total cost per bale by gin groups and volume per stand, South Louisiana, 2-year average, 1948 and 1949 41

28 Total cost of ginning per bale, by size of gin plant and ginning volume, South Louisiana, 2-year average, 1948 and 1949 42

LIST OF FIGURES

FIGURE PAGE

1 Location of parishes included in the study by Grade and staple Reporting Districts, Louisiana, 1948 and 1949 3

2 The distribution of ginnings by lint moisture contents and percentage of normal (B) and rough (C) gin preparation occurring at specified lint moisture contents, South Louisiana, season 1949 11

3 Preparation of lint ginned from seed cotton which had been dried by varying amounts of heat and ginned with loose and tight seed rolls 25

4 The relationship of seed roll density and lint moisture content to rough gin preparation of lint cotton, South Louisiana, season 1949 26

ACKNOWLEDGMENTS

This study was planned and conducted cooperatively by the Production and Marketing Administration of the U. S. Department of Agriculture and Louisiana State University under the general direction of John W. Wright, Chief, and Francis L. Gerdes, In Charge, Stoneville Laboratory, Research and Testing Division, Cotton Branch, PMA, and Bueford M. Gile, Head, Department of Agricultural Economics, Louisiana State University.

The authors wish to express their thanks to Mr Clyde C. McWhorter, Harvey B. Martin and C. C. Tobey of the Cotton Branch, Production and Marketing Administration, for the cooperation received from them in gathering the field data necessary for the study. Special thanks are expressed to Mr. Sidney Bertheaud, Ginner, Opelousas, Louisiana, for the use of his facilities and to the ginners in South Louisiana for their cooperation in making their records available for use in the study and for aiding in the collection of the samples of cotton used.

Quality of Ginning Services in Relation to Cost of Ginning in South Louisiana, 1948 and 1949

JAMES F. HUDSON AND ROBERT A. MONTGOMERY[1]

Cotton production in southern Louisiana has declined only slightly over the past twenty years in spite of a large reduction in the acreage planted. Approximately one-fourth of the Louisiana cotton crop is produced in the South Louisiana cotton area and many of the farmers derive an important part of their income from the sale of cotton (Figure 1). Almost all gins in the area are custom gins providing a public service to the producer who maintains ownership of the cotton in the process of ginning.

The quality of the ginning service available in the area is reflected in the value of the ginned lint and in the farmer's income. Even so, charges for ginning are relatively fixed and normally bear no relation to the quality of the service. The potential value of cotton may be increased or decreased, depending on the extent of plant equipment and its operation during the ginning process. Careless handling by the producer, sometimes practiced during rush seasons, may be offset to some extent by good ginning, while gains normally expected from careful harvesting may be lost by poor ginning.

Premiums and discounts in prices of American cotton should encourage producers who harvest their own crop to pick and handle it in a manner to insure premium grades. An examination of the seasonal average grade of cotton over the past nine years shows this has not been true in South Louisiana, since with the exception of 1947 and 1948, grades have averaged well below Middling (Table 1). Producers in the area lose many dollars each year through careless harvesting or through improper ginning, or a combination of both.

---

[1] Hudson, James F., Assistant Agricultural Economist, Department of Agricultural Economics, Louisiana Agricultural Experiment Station; Montgomery, Robert A., Agricultural Economist, Research and Testing Division, Cotton Branch, Production and Marketing Administration, Stoneville, Mississippi.

TABLE 1. The average grade and staple length of cotton produced in District No. 4, South Louisiana and the proportion reduced in grade due to rough gin preparation 1941 through 1949[1]

Year	Grade[2]	Staple length	Rough gin Preparation[3]
	Index	32nds of an inch	Percent
1941	94.3	33.2	—
1942	95.6	32.6	40.9
1943	97.3	32.7	19.3
1944	95.6	32.1	36.0
1945	93.8	33.1	15.8
1946	96.7	33.1	23.2
1947	100.0	33.4	16.2
1948	99.7	33.6	5.4
1949	96.5	33.7	13.1

[1] Estimated grade and staple length of cotton ginned, South Central area, P.M.A., U. S. Dept. of Agriculture, Memphis, Tenn.

[2] 94 = SLM = Strict Low Middling; 100 = M = Middling; 104 = SM = Strict Middling.

[3] Percent of total ginnings reduced 1 or more grades because of rough gin preparation.

Since 1940 the early season demand for cotton has readily moved the South Louisiana crop into the channels of trade. Should surplus stock develop in the lower grades, the demand for these grades would decline, resulting in wider price discounts in relation to better grades and a corresponding decrease in the value of the crop and a less favorable market for cotton from the area.

OBJECTIVES AND IMPORTANCE OF STUDY

The objectives of this study were: (1) to determine the quality of ginning services provided by gins handling hand-harvested cotton and equipped with varying amounts of cleaning and drying equipment; (2) to ascertain the cost of providing ginning services at gins equipped with different amounts of cleaning and drying machinery; and (3) to develop information concerning the amount of cleaning and conditioning equipment required to provide a satisfactory ginning service to producers in the area.

Both producers and ginners have a direct interest in the comparative efficiency of available ginning facilities as measured in terms of the cost and quality of the services rendered. It is important that farmers realize the opportunity they have for increasing the value of their crop through the use of improved ginning services as well as improved harvesting practices and that the ginner realize his obligation to the farmer and to the economy of the area in providing an efficient and economical ginning service.

The findings of this study will be applicable to other cotton areas where similar harvesting methods are employed and climatic conditions prevail.

METHOD AND SCOPE OF STUDY

The study was conducted in the six parishes centered around Lafayette and Opelousas, Louisiana (Figure 1). These parishes comprise the main cotton producing area in southern Louisiana and are among the highest in the state with respect to the percentage of cotton reduced in grade because of rough gin preparation.

Appraisals were made of 36 gins in the area prior to the 1948 ginning season to determine the extent of plant equipment in the area and to provide information necessary for the classification of the gins for comparative analysis of the quality and cost of ginning data.

On the basis of these appraisals the gins were grouped into two categories: (1) standard gins, those judged capable of doing a credit-

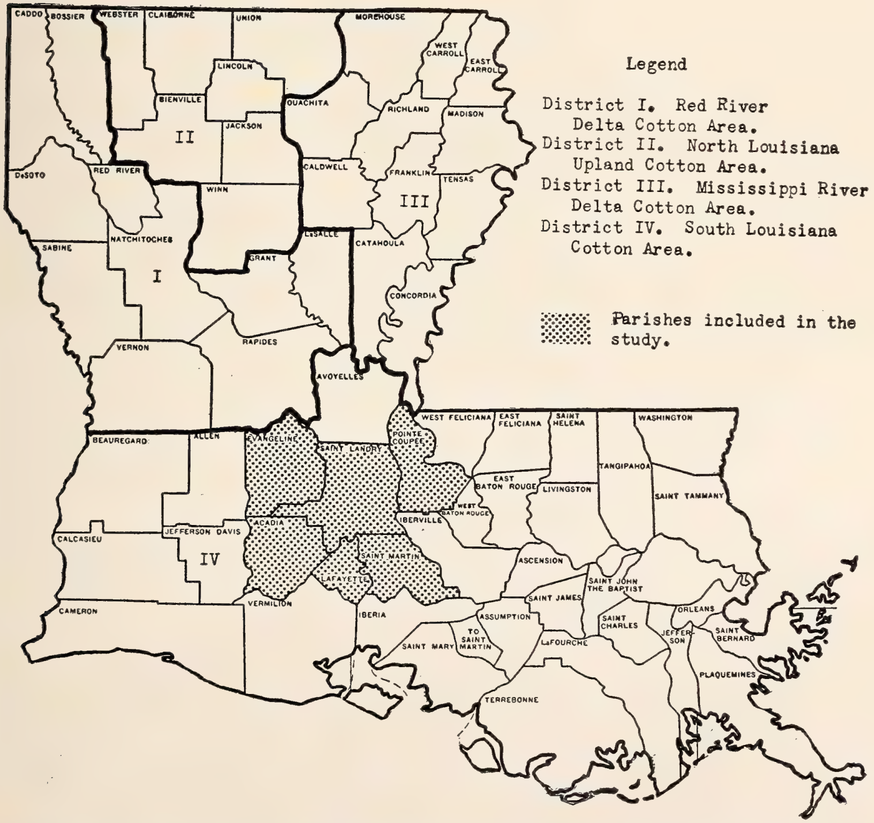


FIGURE 1.—Location of Parishes Included in the Study, by Grade and Staple Reporting Districts, Louisiana, 1948 and 1949.

able job of ginning on relatively clean and dry hand-picked cotton; and (2) substandard gins, the older, more obsolete gins usually in a poor state of repair. This second group was further subdivided into two groups: substandard gins with driers and substandard gins without driers. Only five gins surveyed were without driers, all of which were classified as substandard plants. Only one of the gins in the substandard group employed extractor feeders and none employed overhead cleaning equipment. All gins in the standard group were in good operating condition and had a drier, extractor feeders, or an overhead cleaner and drum feeders, and huller front gin stands.

For the quality phase of the study, samples were taken from four bales of cotton at weekly intervals for a period of four weeks at each of the 36 gins during 1948 and from six bales at weekly intervals for a period of six weeks during 1949. These samples included the following:

Samples of seed cotton to determine foreign matter and moisture content of cotton as delivered at gin.

Samples of seed cotton taken at feeder to determine foreign matter and moisture content after conditioning and cleaning.

Sample of ginned lint for moisture content determination.

Sample of ginned lint for grade and staple classification.

As each bale was sampled, information was recorded on such items as seed board setting, saw speeds, seed roll density, drier temperatures, and extent and use of installed equipment

For the cost phase of the study, data were obtained from the financial records of 31 of the 36 gins during 1948 and from 30 gins during 1949. The sample consisted of 18 standard gins, 9 substandard gins with driers and 4 substandard gins without driers during 1948 and 18, 7, and 5 gins for the three groups, respectively, in 1949. Since the number of gins in the sample classified as substandard without driers was small the substandard groups were combined and used as one group for this phase of the study.

THE GINNING INDUSTRY IN SOUTH LOUISIANA

In 1945 there were 145 gins in operation in South Louisiana, as compared to 148 in 1935 (Table 2). The average volume of cotton handled in this area per gin is relatively small. Since 1930, volumes have fluctuated widely around 850 bales per gin.

During the 10-year period 1935-1945, the number of gins in

TABLE 2. Total number of gins; number equipped with driers; specified doffing equipment; and type of gin stand fronts, South Louisiana, seasons 1935, 1940 and 1945

Year	Total gins	Gins equipped with driers	Gin stands equipped with:		Gins equipped with:		Av. No. of stands per gin
			Huller fronts	Plain fronts	Brush doffing	Air blast doffing	
	Number	Number	Number	Number	Number	Number	Number
1945	145	107	132	13	97	48	3.6
1940	149	67	130	19	108	41	3.6
1935	148	3	97	51	111	37	3.6

Source: "Cotton Ginning Machinery and Equipment in the United States." United States Department of Commerce.

the area equipped with driers increased from 3 to 107. In the same period the number of gins using plain front gin stands decreased from 51 to 13. Several gins have installed additional equipment since 1945. The survey of gins made in connection with this study revealed only a few gins not equipped with driers at that time. Three of the gins surveyed were employing overhead cleaners exclusive of cleaner type driers, and two gins were using two drying systems. The extent of plant equipment ranged from plain front stands with no overhead cleaning or drying to modern gins with huller front stands, extractor feeders, a drier and one incline cleaner. No gin in the area had elaborate overhead cleaning and drying systems and none had installed the newly developed lint cleaners.

Practically all ginners in South Louisiana purchase both cottonseed and lint from the producers at the time they gin their cotton. Purchases of lint are generally made either as an agent for cotton merchants or as independent buyers, who, in turn, sell through one of the several markets operating in the area during the ginning season.

The state of Louisiana has no restrictions on the ownership of gins by oil mills; consequently a large number of gins in the area are owned by them or are otherwise financially connected with them.

ROUGH GIN PREPARATION

Preparation, one of the three factors determining the grade of cotton, denotes the degree of smoothness with which cotton is ginned. It is directly related to the moisture content of the seed cotton, the condition of ginning equipment, and its method of operation. The South Louisiana cotton area has the highest percentage of rough preparation of any area within the state. From 1942 through the 1949 season an average of one-fourth of the cotton ginned in South Louisiana was reduced one or more grades because of rough gin preparation (Table 1).

A study of the relationship of climate and gin machinery to the percentage of rough gin preparation in Louisiana revealed that the largest percentage of monthly ginning reduced one or more grades because of rough preparation occurred during the months having the largest amount of rainfall.[2] It was also found that the cleaning and conditioning equipment employed by the gins and gin stand operating practices affected the preparation of the lint. In addition, certain physical characteristics of the seed cotton, such as immature fibers or weevil damaged locks of cotton, are likely to give the lint a rough or neppy appearance when ginned.

THE RELATIONSHIP OF CONDITION OF SEED COTTON, GIN MACHINERY AND OPERATING PRACTICES TO QUALITY OF GINNING

In quality of ginning studies, conducted by the Cotton Branch of the United States Department of Agriculture throughout the Cotton Belt, it has been found that the better equipped gins in an area usually receive a higher proportion of roughly harvested and wet cotton than the gins not so well equipped. As a result, there is little difference in the average seasonal grades of cotton obtained by gins within an area, regardless of the amount and condition of equipment in the individual gins. These studies have shown that producers recognize the value of auxiliary cleaning and conditioning equipment and take their wet or roughly harvested cotton to the better gins. The less extensively equipped plants, receiving cleaner and drier cotton, are thereby able to turn out an average lint grade equal to or often better than that of poorly harvested cotton ginned on gins employing more cleaning and conditioning equipment. Also the older, more obsolete gins usually cease operating in the latter part of the season when a large part of the crop is harvested rough. Operating practices such as seed roll density and seed board settings also have direct bearing on the grade of lint. It is necessary, therefore, in the comparison of ginning quality performed by gins employing varying amounts of equipment, to consider the condition of the seed cotton as it arrives at the gins and the operating practices used while ginning the cotton.

---

[2] Hudson, James F., "Relationship of Climate and Gin Machinery to Rough Gin Preparation of Cotton in Louisiana." Louisiana Bulletin No. 432, October, 1948.

Moisture Conditions of Seed Cotton

The humid climatic conditions prevailing throughout the growing and harvest seasons in this area necessitate the harvesting of much of the crop in a very green and damp condition. Before driers came into general use throughout the area, farmers delayed their picking or dried their cotton by placing it in the sun or by storing it in the barn and turning it frequently until it was dry enough to gin. As competition from other crops for labor at harvest time increased and gins began to install driers, farmers largely abandoned these home drying practices, thereby placing the problem of excess moisture removal on the gins. As the moisture content of seed cotton is one of the principal factors that influence the preparation of the ginned lint, the removal of excess moisture is of paramount importance in this area.

Tests designed to determine the effect of drying on lint grades have shown grade improvements averaging one-third of a grade as a result of drying seed cotton with an original moisture content ranging from 12.0 to 15.9 per cent, and one full grade improvement on cotton containing over 16.0 per cent moisture.[3] No improvement in grade resulted in drying seed cotton containing 12.0 per cent or less moisture. These tests were conducted on gins employing no cleaning equipment other than drum feeders and huller front gin stands.

Over 90 per cent of the 1949 South Louisiana crop was harvested and arrived at the gins containing moisture in excess of 12.0 per cent. During the 1948 season, one of the most favorable, approximately 60 per cent of the crop was brought to the gins in such condition as to warrant artificial drying (Table 3).

There were no significant differences in the moisture content of the seed cotton received by the three groups of gins. In both 1948 and 1949, gins without driers received cotton having the same seasonal average moisture content as did the standard gins (Tables 4 and 5). For both seasons the substandard gins with driers received cotton with only slightly less moisture than the standard gins or substandard gins without driers. The 1948 crop averaged slightly more than

---

[3] F. L. Gerdes and C. A. Bennett. "Effect of Artificially Drying Seed Cotton Before Ginning on Certain Quality Elements of the Lint and Seed and on the Operation of the Gin Stand." U. S. Department of Agriculture Technical Bulletin No. 508, May, 1936.

TABLE 3. The percentage of cotton arriving at gins with 12 percent or less moisture in the seed cotton, and the percent of ginnings with lint moisture content of 6.9 percent or less, by gin groups, South Louisiana, seasons of 1948 and 1949[1]

Gin Groups	1948 season		1949 season	
	Seed cotton containing 12 per cent or less moisture upon arrival at gin	Lint containing 6.9 percent or less moisture	Seed cotton containing 12 per cent or less moisture upon arrival at gin	Lint containing 6.9 percent or less moisture
	Percent	Percent	Percent	Percent
Standard	39.8	48.0	8.5	45.9
Substandard:				
With driers	47.4	44.6	6.9	25.6
Without driers	38.7	.7	1.6	0

[1]Seasonal averages, weighted by the number of bales ginned by gins in each group.

13 per cent in seed cotton moisture content when it arrived at the gins. By comparison, the 1949 crop contained approximately 3 per cent additional moisture, or slightly more than 16 per cent. For each month throughout the latter season the seed cotton averaged 15 per cent or more moisture, and the first ginnings sampled at the standard gins contained 23.9 per cent seed cotton moisture.

The standard gins were the most efficient in removing excess moisture from seed cotton. This group removed an average of 12.5 and 14.0 per cent, or one-eight and one-seventh of the seed cotton moisture in 1948 and 1949, respectively. Substandard gins with driers removed 10.8 and 9.9 per cent, while the substandard gins without driers removed only 2.9 and 5.5 for the 1948 and 1949 seasons, respectively.

For all but the first ginning period of 1948, and for the season as a whole, the standard gins and substandard gins with driers were successful in reducing the average seed cotton moisture to below 12 per cent before it reached the gin saws. For most efficient ginning it is desirable that the seed cotton moisture content be below 12 per cent when it reaches the gin saws. None of the gins were able to lower the seed cotton moisture before ginning to this extent in the 1949 season. Although the standard gins removed almost one-fourth of the seed cotton moisture by weight from their first ginnings, there remained 18.6 per cent moisture in the seed cotton as it reached the gin saws. It was noted that one-half of these bales sampled during

TABLE 4. Seed cotton moisture content and removal, and lint moisture content, by gin groups, for specified ginning periods and for the season, South Louisiana, season 1948[1]

Gin group	Moisture content per 100 pounds seed cotton			Moisture content per 100 pounds of lint
	Wagon[2]	Feeder[3]	Removal	
	Pounds	Pounds	Percent	Pounds
		To August 21		
Standard	15.0	12.8	14.7	7.1
Substandard:				
With driers	14.8	12.9	12.8	7.2
Without driers	14.8	13.8	6.8	9.8
		August 22-28		
Standard	12.4	11.2	9.7	7.5
Substandard:				
With driers	12.1	11.4	5.8	7.3
Without driers	12.4	12.1	2.4	9.5
		August 29-September 4		
Standard	14.4	11.7	18.8	7.4
Substandard:				
With driers	12.9	11.8	8.5	7.0
Without driers	13.0	12.9	.8	9.5
		After September 4		
Standard	12.0	11.0	8.3	7.0
Substandard:				
With driers	11.5	10.2	11.3	7.1
Without driers	13.2	13.0	1.5	9.6
		Seasonal averages		
Standard	13.6	11.9	12.5	7.1
Substandard:				
With driers	13.0	11.6	10.8	7.1
Without driers	13.6	13.2	2.9	9.6

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group for each period and for season.

[2] Indicates amount of moisture in seed cotton prior to conditioning.

[3] Indicates amount of moisture in seed cotton after conditioning.

TABLE 5. Seed cotton moisture content and removal, and lint moisture content, by gin groups, for specified ginning periods and for the season, South Louisiana, season 1949[1]

Gin group	Moisture content per 100 pounds of seed cotton			Moisture content per 100 pounds of lint
	Wagon[2]	Feeder[3]	Removal	
	Pounds	Pounds	Percent	Pounds
		First ginnings		
Standard	23.9	18.6	22.2	10.4
		Early season		
Standard	18.5	15.5	16.2	7.0
Substandard:				
With driers	17.3	15.6	9.8	8.4
Without driers	18.2	18.2	0	11.1
		Mid-season		
Standard	15.0	13.4	10.7	7.0
Substandard:				
With driers	15.8	14.6	7.6	8.0
Without driers	16.7	15.7	6.0	10.6
		Late season		
Standard	16.7	14.0	16.2	7.8
Substandard:				
With driers	16.0	14.1	11.9	8.6
Without driers	15.9	15.1	5.0	10.3
		Seasonal averages		
Standard	16.4	14.1	14.0	7.4
Substandard:				
With driers	16.2	14.6	9.9	8.3
Without driers	16.4	15.5	5.5	10.5

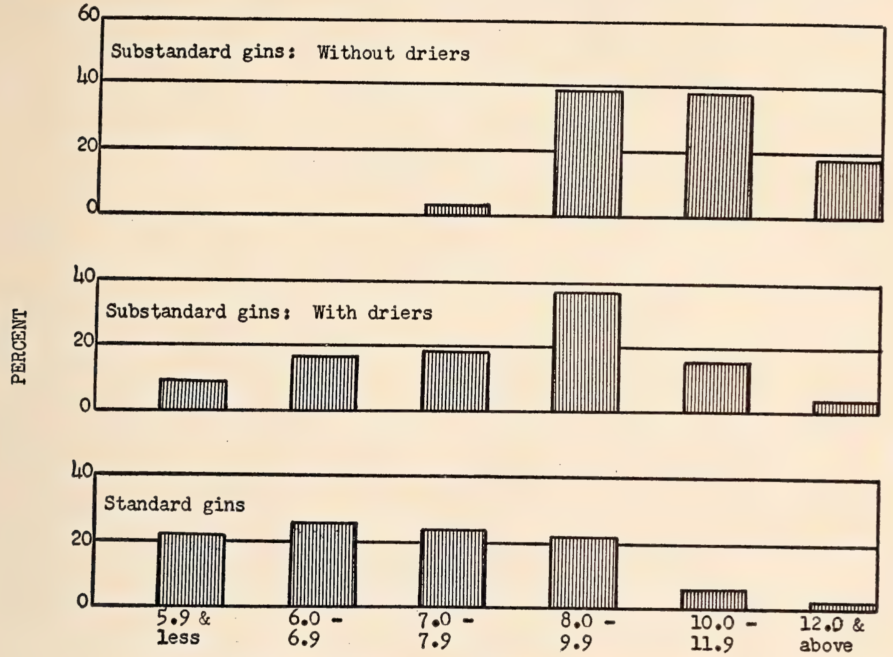
[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group for each period and for season.

[2] Indicates amount of moisture in seed cotton prior to conditioning.

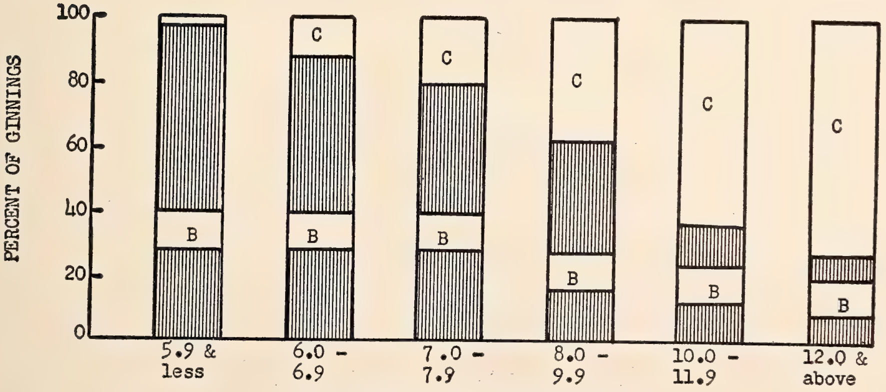
[3] Indicates amount of moisture in seed cotton after conditioning.

this period were passed through the drier twice before ginning. To reduce the moisture content of this cotton to 12 per cent or below would have required additional drying equipment, with an estimated capacity two or three times as great as that now in use.

Moisture removed from seed cotton in the cleaning and drying process at the gin is primarily moisture removed from the lint.[4] Standard gins turned out lint that averaged 7.1 per cent moisture in 1948 and 7.4 per cent in 1949. Ginnings of the substandard gins equipped with driers in 1948 averaged 7.1 per cent lint moisture, or the same as standard gins, and 8.3 per cent in 1949. Substandard



Distribution of ginnings by lint moisture contents



Moisture per 100 pounds of lint

FIGURE 2.—The Distribution of Ginnings by Lint Moisture Contents and the Percentage of Normal (B) and Rough (C) Gin Preparation Occurring at Specified Lint Moisture Contents, South Louisiana, Season 1949.

---

[4] Ibid.

gins not equipped with driers turned out lint that contained an average of 9.6 per cent moisture in the 1948 season and 10.5 per cent in the 1949 season.

An analysis of the relationship of lint moisture to rough gin preparation in 1949 revealed that each increase in the moisture content of the lint resulted in additional increases in the proportion of bales reduced in grade because of rough gin preparation (Figure 2). Only 3.0 per cent of ginnings with a lint moisture content of 5.9 per cent or less were reduced in grade because of rough gin preparation, whereas 72.2 per cent were reduced when the lint moisture was 12.0 per cent or greater. Within the normal or relatively dry lint moisture ranges of 6.0 to 6.9 per cent and 7.0 to 7.9 per cent, 13.0 and 21.0 per cent, respectively, of the ginnings were reduced in grade. Thus efficient drying of the seed cotton is desirable. The possibility of effecting significant reductions in the proportion of rough preparation in this area through employment of additional drying capacities is illustrated by the fact that only 3 per cent of the bales were reduced in grade when the lint moisture content was below 6.0 per cent, as compared to 13.0 per cent when the lint moisture content ranged from 6.0 to 6.9 per cent.

Although excess moisture in the fiber is a principal factor causing rough preparation in the area, it is apparent that certain physical characteristics of the seed cotton and lint in conjunction with lint moisture content have a direct bearing on the preparation element of lint grades. The effect of lint moisture content in combination with varying staple length on rough gin preparation may account for a small proportion of the additional rough preparation found in the lower lint moisture ranges in 1949. Staple length of the 1949 crop was approximately 1/32 of an inch longer than that for the 1948 crop. Weevil infestation was extremely heavy in 1949 and the motiness of weevil-damaged locks of seed cotton accounted for part of the increased rough preparation. Rank plant growth and frequent rainfall throughout the 1949 harvest season prohibited normal boll openings on the stalk, and as a result, much of the cotton was picked with the locks of seed cotton in a compact form similar to locks in unopened bolls. Unless these locks of seed cotton are opened or fluffed in the drying, cleaning, and extracting processes, the lint will be removed by the gin saws in the form of tangled or matted tufts of fibers, referred to in the cotton trade as naps.

Foreign Matter Content and Removal

While the foreign matter content of cotton as harvested in this area is relatively low and the extent of plant equipment limited, findings of this study reveal that both the amount of foreign matter in the seed cotton received by the gins and the equipment employed in its removal have a direct relationship to the resulting lint grades (Tables 6 and 7). The uniformity of color and the relatively small

TABLE 6. Foreign matter content and differences of seed cotton before conditioning and cleaning that produced SM, M, and SLM lint grades after ginning on standard and substandard gins, South Louisiana, season 1948

Grade of lint	Foreign matter content: Standard gins	Foreign matter content: Substandard gins	Differences in foreign matter content, by gin groups
	Percent	Percent	Percent
SM	.9	.7	.2
M	1.5	1.2	.3*
Difference of grades	.6*	.5*	
M	1.5	1.2	.3*
SLM	2.9	2.1	.8
Difference of grades	1.4*	.9	

*Indicates differences are significant.

TABLE 7. Foreign matter content and differences of seed cotton before conditioning and cleaning that produced SM, M and SLM lint grades after ginning on standard gins, substandard gins with driers and substandard gins without driers, South Louisiana, season 1949

Grade of lint	Foreign matter content			Differences in foreign matter content, by gin groups	
	Standard gins	Substandard gins: With driers	Substandard gins: Without driers	standard and sub-Standard with driers	Standard and sub-standard without driers
	Percent	Percent	Percent	Percent	Percent
SM	.7	.7	.5	0	.2
M	1.0	.8	.7	.2*	.3*
Difference in grade	.3	.1	.2		
SM	.7	.7	.5	0	.2
SLM	1.1	1.4	1.0	.3	.1
Difference in grade	.4	.7*	.5		
M	1.0	.8	.7	.2*	.3*
SLM	1.1	1.4	1.0	.3	.1
Difference in grade	.1	.6*	.3		

*Indicates differences are significant.

proportion of rough preparation permitted a comprehensive study of the efficiency of foreign matter removal by the different gin groups in 1948. Significant differences were found to exist in the foreign matter content of seed cotton that graded Strict Middling, Middling, and Strict Low Middling after being ginned on standard gins. For the same year an increase in the average foreign matter present before ginning of 0.5 per cent, or 6 to 7 pounds per bale of seed cotton, resulted in a decrease in grade from Strict Middling to Middling when the seed cotton was ginned on substandard gins (Table 8). For seed cotton ginned on standard gins, the average foreign matter content before drying and clearing by lint grade intervals, ranged from 0.9 per cent for Strict Middling lint to 5.9 per cent for Low Middling plus lint. When ginned on substandard gins, foreign matter content ranged from 0.7 per cent for Strict Middling to 2.1 per cent for Strict Low Middling lint.

TABLE 8. The average foreign matter content of seed cotton before and after cleaning that produced specified lint grades after being ginned on standard and substandard gins, South Louisiana, season 1948

Grade		Standard gins		Substandard gins	
		Foreign matter content per 100 pounds of seed cotton		Foreign matter content per 100 pounds of seed cotton	
Desig.	Index	Before cleaning	After cleaning	Before cleaning	After cleaning
		Percent	Percent	Percent	Percent
SM	104	.9	.5	.7	.5
M+	101	1.1	.6	1.0	.7
M	100	1.5	.7	1.2	.8
M -	98	1.6	.9	1.5	.9
SLM+	96	1.8	.9	1.5	1.1
SLM	94	2.9	1.1	2.1	1.2
SLM -	91	3.3	1.3	-	-
LM+	88	5.9	1.4	-	-

Of more significance is the comparative efficiency of the two groups of gins in the removal of foreign matter from seed cotton. The greater effectiveness of the standard gins is illustrated by the differences in average foreign matter content of the seed cotton required to produce lint of similar grades at the two groups of gins. While standard gins were able to obtain Middling grades from seed cotton containing an average of 1.5 per cent foreign matter, substandard gins required cleaner cotton containing an average of 1.2 per cent foreign matter to produce Middling lint. Substandard gins required seed cotton containing 0.8 per cent less foreign matter than standard gins to produce Strict Low Middling lint cotton, or 2.1 as compared with 2.9 per cent. The fact that the foreign matter content of seed cotton after cleaning by both gin groups was practically the same for identical lint grades offers conclusive evidence that standard gins performed a superior service for the cotton growers.

Similar differences existed in 1949, both as to the average seed cotton foreign matter content requirements for specified grades ginned by the same gin groups, and the average seed cotton foreign matter required to produce similar grades of lint when ginned at different groups of gins.

The importance of adequate drying in obtaining maximum efficiency from cleaning and extracting machinery is illustrated by the effectiveness of all gins in the removal of foreign matter from seed cotton for the wet season of 1949 and the dry season of 1948. All groups of gins were less efficient in the removal of foreign matter in 1949, requiring cleaner seed cotton to produce lint grades comparable to those obtained in 1948. Standard gins obtained Middling lint from seed cotton containing 1.5 per cent foreign matter in 1948 and 1.0 per cent in 1949. Substandard gins ginned Middling lint from seed cotton having 1.2 per cent foreign matter in 1948, as compared to 0.8 and 0.7 per cent for the substandard gins with and without driers, respectively, in 1949.

In 1948 the seed cotton received by the standard gins contained 0.3 per cent more foreign matter than the cotton received by the substandard gins with driers and 0.8 per cent more, or twice the amount received by the substandard gins without driers (Tables 9 and 10). The seed cotton after conditioning and cleaning by the standard gins contained less foreign matter than seed cotton handled by the substandard gins without driers and only 0.1 of one per cent more than the seed cotton cleaned by the substandard gins with driers. Standard gins removed an average of 56.2 per cent of the foreign matter from their seasonal ginnings, as compared with 38.5 and 25.0 per cent removed by the substandard gins with driers and the substandard gins without driers, respectively.

Again, in the season of 1949 the standard gins received seed cotton containing more foreign matter than that received by either group of substandard gins. The seed cotton processed by the standard gins,

TABLE 9. Seed cotton foreign matter content and removal, by gin groups and ginning period, South Louisiana, season 1948[1]

Ginning period	Gin groups								
	Standard gins			Substandard gins:					
				With driers			Without driers		
	Foreign matter content per 100 pounds seed cotton			Foreign matter content per 100 pounds seed cotton			Foreign matter content per 100 pounds seed cotton		
	Wagon[2]	Feeder[3]	Removal	Wagon[2]	Feeder[3]	Removal	Wagon[2]	Feeder[3]	Removal
	Pounds	Pounds	Percent	Pounds	Pounds	Percent	Pounds	Pounds	Percent
To Aug. 21	1.4	.6	57.1	1.2	.8	33.3	.7	.5	28.6
Aug. 22-28	1.3	.7	46.2	1.1	.7	36.4	.6	.5	16.7
Aug. 29 - Sept. 4	2.0	.8	60.0	1.5	.7	53.3	.9	.6	33.3
After Sept. 4	2.0	.9	55.0	1.5	1.0	33.3	.9	.6	33.3
Seasonal average	1.6	.7	56.2	1.3	.8	38.5	.8	.6	25.0

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group for each period and for season.

[2] Indicates amount of foreign matter in seed cotton prior to conditioning and cleaning.

[3] Indicates amount of foreign matter in seed cotton after conditioning and cleaning.

TABLE 10. Seed cotton foreign matter content and removal, by gin groups and by ginning periods, South Louisiana, season 1949[1]

Ginning period	Gin groups								
	Standard gins			Substandard gins					
				With driers			Without driers		
	Foreign matter content per 100 pounds seed cotton			Foreign matter content per 100 pounds seed cotton			Foreign matter content per 100 pounds seed cotton		
	Wagon[2]	Feeder[3]	Removal	Wagon[2]	Feeder[3]	Removal	Wagon[2]	Feeder[3]	Removal
	Pounds	Pounds	Percent	Pounds	Pounds	Percent	Pounds	Pounds	Percent
First ginnings	1.9	.6	68.4	......	......	......	.....	......	......
Early season	2.0	.8	60.0	1.2	1.0	16.7	1.0	.8	20.0
Mid-season	1.2	.6	50.0	.9	.7	22.2	.7	.7	0
Late season	1.7	.8	52.9	.9	.8	11.1	1.1	.8	27.3
Seasonal average	1.5	.7	53.3	1.0	.8	20.0	1.0	.8	20.0

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group for each period and for season.

[2] Indicates amount of foreign matter in seed cotton prior to conditioning and cleaning.

[3] Indicates amount of foreign matter in seed cotton after conditioning and cleaning.

although containing one-third more foreign matter, was cleaned to such an extent that the foreign matter remaining in the seed cotton as it reached the gin stand was less than that contained in the seed cotton ginned on the substandard plants. During the latter part of the season, when substandard plants received a substantial part of their total volume, the foreign matter in seed cotton arriving at gins consisted largely of burs. Therefore, the removal of this type of foreign matter, while important in the final analysis, does not have the same effect on grades, in this area in particular, as does the removal of leaf and small pin trash.

Grade and Value of Lint

As previously stated, the 1948 growing and harvesting season in South Louisiana was one of the most favorable on record. Lint grades were well above average and the proportion of bales reduced in grade because of rough gin preparation was the smallest in recent years (Table 11).

Seasonal average grades obtained in 1948 at the substandard gins without driers were slightly higher than those at either standard gins or substandard gins with driers. The higher grades for gins of this group are readily attributable to the fact that these gins received seed cotton containing only one-half the amount of foreign matter present in the seed cotton received by standard gins and two-thirds of that received by the substandard gins with driers. If all gins had received seed cotton equal in foreign matter content, pronounced grade differences in favor of the better gins would have been evident. As the moisture content of the 1948 crop was unusually low for this area, only 3.9 and 3.2 per cent of the seasonal ginnings of the standard gins and substandard gins with driers, respectively, were reduced in grade because of rough preparation. Substandard gins not equipped with driers had over twice this amount, or 8.4 per cent, reduced one or more grades.

During each ginning period in 1949 when the moisture content of seed cotton was high, standard gins produced higher lint grades than either group of substandard gins (Table 12). The seasonal average grade of the standard gins was also higher, although this group ginned a considerable amount of very low grade, early season cotton, thereby lowering the seasonal average grades of this group proportionately. Substandard gins equipped with driers averaged slightly higher grades than did the substandard gins not equipped with driers. The higher grades from gins equipped with driers is

TABLE 11. Quality of ginning, by gin groups and ginning periods, as measured by lint classification, staple length, and preparation, South Louisiana, season 1948[1]

Gin groups	Grade		Color		Leaf		Preparation[3]	Staple[4]
	Index[2]	Desig.	Index[2]	Desig.	Index[2]	Desig.	Per cent	32nd of an inch
To August 21								
Standard	101.1	M+	101.4	M+	101.6	M+	2.5	33.5
Substandard								
With driers	100.9	M+	101.2	M+	101.5	M+	2.5	33.3
Without driers	101.9	M+	102.8	SM—	103.0	SM—	11.6	33.4
August 22-28								
Standard	101.0	M+	101.6	M+	101.7	M+	3.8	33.5
Substandard								
With driers	101.2	M+	101.5	M+	101.8	M+	2.1	33.4
Without driers	101.3	M+	102.0	M+	102.2	SM—	8.3	33.5
August 29 - September 4								
Standard	98.3	M—	98.6	M—	99.6	M	0	33.4
Substandard								
With driers	100.2	M	100.5	M	101.3	M+	0	33.7
Without driers	100.2	M	100.8	M+	101.3	M+	0	33.9
After September 4								
Standard	97.1	M—	97.8	M—	99.2	M	7.2	32.9
Substandard								
With driers	97.9	M—	99.0	M	99.5	M	5.3	33.3
Without driers	99.0	M	100.3	M	101.5	M+	9.1	33.8
Seasonal averages								
Standard	99.4	M	99.9	M	100.6	M+	3.9	33.3
Substandard								
With driers	99.7	M	100.3	M	100.8	M+	3.2	33.4
Without driers	100.6	M+	101.6	M+	102.2	SM—	8.4	33.6

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group and for each period and for season.

[2] Computed by weighting the quantity in each grade by the 1937-39 average price per pound for each grade for 15/16 inch staple; converted to an index on basis: 94 = SLM = Strict Low Middling; 100 = M = Middling; and 104 = SM = Strict Middling. Fractional grade values determined by designating the midpoint of the range between grade values and below as the lower grade plus, and values above the midpoint as the higher grade minus.

[3] Percent of total ginnings reduced 1 or more grades because of rough preparation.

[4] 32=1 inch; 33 = 1-1/32 inch; and 34 = 1-1/16 inch.

TABLE 12. Quality of ginning, by gin groups and ginning periods, as measured by lint classification, staple length, and preparation, South Louisiana, season 1949[1]

Gin groups	Grade		Color		Leaf		Preparation[3]	Staple[4]
	Index[2]	Desig.	Index[2]	Desig.	Index[2]	Desig.	Percent	32nd of an inch
			First ginnings					
Standard	91.4	SLM—	98.3	M—	98.3	M—	93.3	33.4
Substandard								
With driers	....	....	....	....	....	....	....	....
Without driers	....	....	....	....	....	....	....	....
			Early season					
Standard	96.7	SLM+	98.4	M—	99.3	M	23.6	33.8
Substandard								
With driers	95.1	SLM+	97.6	M—	98.3	M—	31.6	34.0
Without driers	95.7	SLM+	99.6	M	100.5	M	69.2	33.9
			Mid-season					
Standard	98.3	M—	99.6	M	99.3	M	16.8	34.0
Substandard								
With driers	97.0	SLM+	99.1	M	98.6	M—	28.9	33.9
Without driers	96.6	SLM+	100.3	M	100.7	M+	61.8	34.2
			Late season					
Standard	95.1	SLM+	97.1	M—	97.4	M—	16.4	33.8
Substandard								
With driers	95.8	SLM+	97.7	M—	98.6	M—	21.4	33.9
Without driers	94.1	SLM	97.5	M—	98.5	M—	57.1	33.8
			Seasonal averages					
Standard	96.6	SLM+	98.3	M—	98.5	M—	19.3	33.9
Substandard								
With driers	96.2	SLM+	98.2	M—	98.5	M—	26.5	33.9
Without driers		SLM+	98.6	M—	99.4	M	59.6	34.0

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group and for each period and for season.

[2] Computed by weighting the quantity in each grade by the 1937-39 average price per pound for each grade for 15/16 inch staple; converted to an index on basis: 94 = SLM = Strict Low Middling; 100 = M = Middling and 104 = SM = Strict Middling. Fractional grade values determined by designating the midpoint of the range between grade values and below as the lower grade plus, and values above the midpoint as the higher grade minus.

[3] Percent of total ginnings reduced 1 or more grades because of rough preparation.

[4] 32 = 1 inch; 33 = 1-1/32 inch; and 34 = 1-1/16 inch.

primarily due to the lower proportion of rough preparation at these gins. It is interesting to note that for each gin period, excluding first ginnings, the composite grade average for standard gins and substandard gins with driers is one-third grade lower than the color and leaf elements of grade, while this difference on substandard gins without driers is two-thirds of a grade in each instance.

Based on Government loan prices for 1-1/16 inch cotton at Opelousas, Louisiana, the seasonal average value per bale for cotton ginned on standard gins was $1.08 higher than cotton ginned on substandard gins with driers, and $2.50 higher than cotton ginned on substandard gins without driers (Table 13). When the preparation factor of grade is eliminated and bale values are adjusted upward accordingly, the average bale values for the three gin groups are approximately the same, with the substandard group without driers being slightly higher. This is relatively the same situation that existed with respect to average grade in 1948 when the proportion of rough preparation was much lower for all gins. It should be recalled, however, that the grades obtained at the standard gins were from seed cotton containing one-third more foreign matter than that which was ginned by the substandard gins. A comparison of average bale values for actual grades and estimated grades, assuming all bales were smooth, reveals the standard gins had an estimated seasonal loss of $2.31 per bale due to rough gin preparation, as compared to $3.33 per bale loss for substandard gins with driers and $5.67 per bale for substandard gins without driers. On the first ginnings of the standard gins, when the seed cotton contained 23.9 per cent moisture and 93.3 per cent of the bales were reduced one or more grades because of rough gin preparation, the average loss on this cotton was $13.98 per bale. This emphasizes the importance of careful harvesting practices followed by farm drying if any of the gins are to perform a good job of ginning.

Lint Moisture As Related To Monetary Returns To Farmers

Since the extra weight gained in high moisture-content cotton has somewhat restricted the employment of driers in this area, an analysis of the relationship of lint moisture to monetary returns to the producer was made on the 1949 crop. As previously stated, it was found that the moisture content of the lint at the time of ginning was directly related to the preparation element of grade, and that increasing proportions of roughly ginned cotton occurred at increasingly higher lint-moisture contents. Also related to the moisture

TABLE 13. The relationship of lint moisture content to rough gin preparation, turnout, and monetary returns to the producer, by gin groups and ginning periods, South Louisiana, season 1949[1]

Gin groups	Value of lint per bale			Turnout	Lint moisture	
	Actual gin preparation[2]	Normal gin preparation[3]	Loss due to preparation		Per 100 pounds of lint	Per bale in excess 7.0%[4]
	Dollars	Dollars	Dollars	Percent	Pounds	Pounds
		First ginnings				
Standard	135.46	149.44	13.98	36.2	10.4	16.3
		Early season				
Standard	145.66	148.23	2.57	37.4	7.0	0
Substandard						
With driers	140.72	146.06	5.34	36.8	8.4	6.7
Without driers	145.54	151.14	5.60	36.8	11.1	19.6
		Mid-season				
Standard	149.25	150.81	1.56	36.6	7.0	0
Substandard						
With driers	147.20	149.81	2.61	36.6	8.0	4.8
Without driers	145.92	151.67	5.75	36.4	10.6	17.2
		Late season				
Standard	142.82	145.17	2.35	37.1	7.8	3.8
Substandard						
With driers	144.08	147.09	3.01	37.0	8.6	7.7
Without driers	141.41	147.05	5.64	36.9	10.3	15.8
		Seasonal average				
Standard	145.71	148.02	2.31	36.9	7.4	1.9
Substandard						
With driers	144.63	147.96	3.33	36.8	8.3	6.2
Without driers	143.21	148.88	5.67	36.7	10.5	16.8

[1] Averages for ginning period and for season are weighted by number of bales ginned by gins in each group for each period and for season.

[2] Bale values for actual gin preparation determined by applying loan rates for grade of bale sampled to 500-lb. bale of 1-1/16 inch cotton at Opelousas Louisiana.

[3] Estimated bale value for normal gin preparation determined by adjusting upward the grades of all rough bales on basis of color, leaf and normal preparation, and applying loan rates as previously described.

[4] Lint moisture of 7 percent is considered normal.

content of the seed cotton and, consequently, to the lint moisture at time of ginning, is gin turnout, or proporton of lint weight to seed cotton weight. Significantly, it was found that gains in weight from excess moisture were more than offset by the loss of lint through the failure of the gins to remove as much lint from the seed when the cotton contained excess moisture. Gins not employing driers turned out lint containing as much as 20 pounds of moisture per bale more than similar seed cotton ginned on standard gins employing driers. However, for each gin period and for the season as a whole, gins employing driers were able to give the producer more weight in the form of actual lint for each pound of seed cotton than were gins not employing driers. Although the differences in turnout by weight between the gin groups were small, the differences in actual pounds of lint were great, being as high as 20 pounds per 500-pound bale. Producers patronizing gins not equipped with driers in 1949 were placing cotton on the market containing 16.5 pounds of excess moisture and a correspondingly less amount of lint per bale. As cotton containing excess moisture rapidly loses weight, generally buyers make allowances in the average prices paid in areas from which such cotton is consistently shipped. Therefore, all producers and ginners alike are generally penalized in any area where such conditions exist.

There was no appreciable difference in the staple length of cotton ginned by the three groups of gins. The average staple length of the 1949 crop was slightly longer than the 1948 crop. In 1948 the staple length was 1-1/32 of an inch as compared to 1-1/16 of an inch for the 1949 crop. An analysis of the relationship of drier temperature to staple length indicated that the amount of drying used had no significant effect on the staple length (Table 14).

An analysis of the grades of crop reporting or statistical gins located in South Louisiana was made for the 1949 crop. These gins were selected to furnish samples from cotton ginned, to be used as a basis for cotton quality estimates. The seasonal average per bale value for cotton ginned at these gins ranged from $134.88 to $151.15, a difference of $16.27 per bale (Table 15). The average loss due to rough gin preparation ranged from 23 cents per bale to $5.40 per bale, with an average loss of $1.49 per bale for all gins. All of these gins were equipped with driers. This illustrates further the significance

TABLE 14. The effect of drying temperature on staple length, South Louisiana, seasons of 1948 and 1949[1]

Year	Drier temperature		
	No drying	Below 200 degrees	200 degrees and above
	32nd of an inch	32nd of an inch	32nd of an inch
1948	33.4	33.3	33.4
1949	34.7	34.0	33.9

[1] Simple averages.

TABLE 15. Estimated average loss in value per bale resulting from rough gin preparation for 11 crop reporting gins, South Louisiana, seasons of 1948 and 1949[1]

Gins	Actual cash value per bale	Estimated cash value per bale if all bales were smooth	Loss per bale due to rough preparation
	Dollars	Dollars	Dollars
No. 1	134.88	137.60	2.72
2	147.04	147.93	.89
3	150.65	151.31	.66
4	149.04	149.40	.36
5	148.58	149.75	1.17
6	147.31	148.53	1.22
7	151.15	151.38	.23
8	147.53	148.80	1.27
9	146.24	147.31	1.07
10	143.32	148.72	5.40
11	146.92	148.01	1.09
All gins	145.67	147.16	1.49

[1] Actual bale values determined by applying loan rates for 1-1/16 inch cotton at Opelousas, Louisiana, to average grade for each gin. Estimated value for smoothly ginned cotton determined by adjusting upward the grades of all roughly ginned cotton on basis of color, leaf and normal preparation, and applying loan rate as previously described.

of proper ginning in relation to the cotton producer's income.

Preventing Gin Damage To Cotton

Damage to cotton in ginning is caused by poor ginning preparation. Preparation, one of the three elements considered in determining grade, is determined by such factors as the nappiness, neppiness, stringiness, roughness, and matiness of the ginned lint (Figure 3). If ginned properly, cotton has a smooth, even appearance whereas improperly ginned lint has a rough, tangled appearance.

As has been previously stated, excess moisture is responsible for most of the rough preparation in South Louisiana. Excess moisture in seed cotton may cause seed rolls to run tight, especially if the fibers are so wet that they are not readily doffed from the gin saws. Thus the gin saws remove the lint from the seed in tangled or matted tufts of fibers. Even when seed cotton is dry, tight seed rolls will cause rough preparation because the heavy mass of fiber on the saw teeth is damaged as it passes through the rib slots. The tighter the seed roll the greater the damage to the quality of the lint. It is difficult to maintain a loose seed roll with extremely wet or

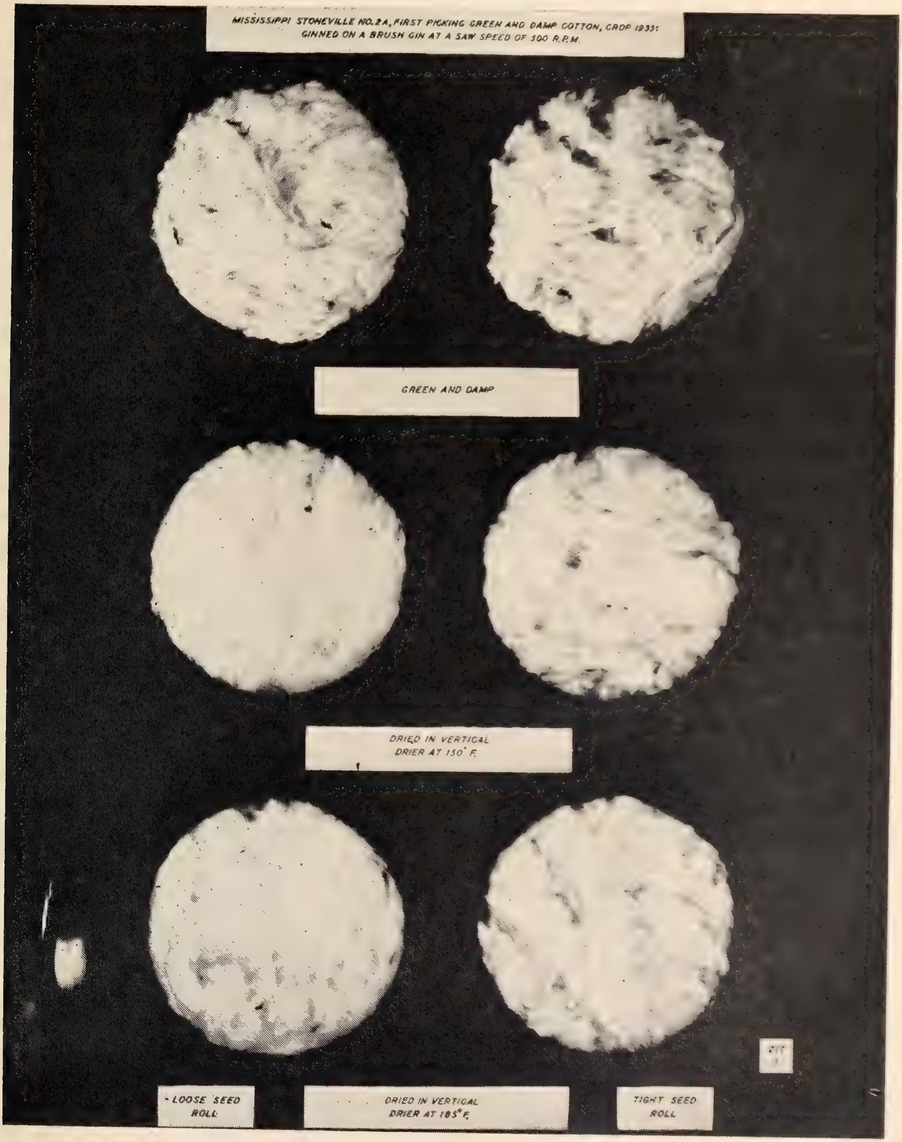

MISSISSIPPI STONEVILLE NO. 2A, FIRST PICKING GREEN AND DAMP COTTON, CROP 1933: GINNED ON A BRUSH GIN AT A SAW SPEED OF 300 R.P.M.
GREEN AND DAMP
DRIED IN VERTICAL DRIER AT 150° F.
LOOSE SEED ROLL
DRIED IN VERTICAL DRIER AT 185° F.
TIGHT SEED ROLL

FIGURE 3.—Preparation of Lint Ginned from Seed Cotton which Had Been Dried by Varying Amounts of Heat and Ginned with Loose and Tight Seed Rolls.

green seed cotton. With this type of cotton the seed roll will be dense or heavy although the roll box may be only half filled with cotton.

To determine the effect of seed roll density on the preparation of lint in South Louisiana, seed roll densities were checked on every bale from which samples were secured. It was found that tight rolls produced considerably more rough preparation, and at the lint moisture range of 8.0 and 9.9 per cent the percentage was double that for similar lint ginned with a loose seed roll (Figure 4). At lint moistures of 9.9 per cent and above, roll densities were recorded as loose when roll boxes were not completely filled; however, these seed rolls were not loose in the usual use of the term loose, since damp cotton will make a compact roll even when the roll box is not completely full. In effect, practically all cotton having a lint moisture content of 9.9 per cent or above can be considered as having been ginned with a dense seed roll.

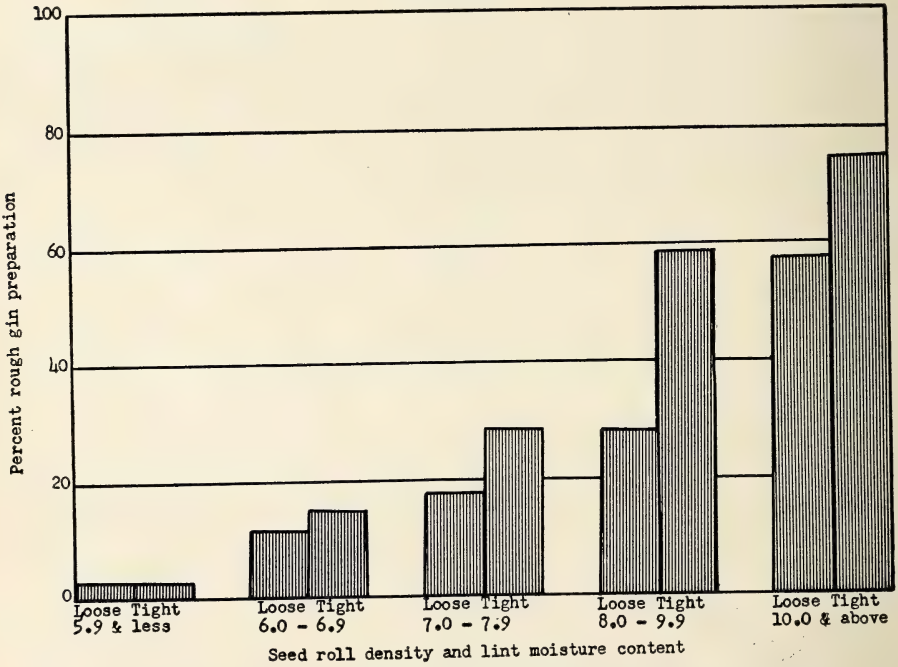


FIGURE 4.—The Relationship of Seed Roll Density and Lint Moisture Content to Rough Gin Preparation of Lint Cotton, South Louisiana, Season 1949.

It is evident from the data presented that both the ginner and the producer have a responsibility in reducing the amount of gin-damaged cotton. The producer can help by furnishing the ginner with cotton in good ginning condition and by demanding that the ginner employ effective ginning methods that will best preserve lint quality. The ginner can help by adopting the very best ginning practices and methods. Modern gin equipment and better ginning establishments will improve the quality of the ginned lint. Ginners can insist that growers furnish them with cotton in good ginning condition and encourage them to employ better harvesting practices.

COST OF GINNING

The financial benefits that may be derived by farmers from improved ginning service in South Louisiana have been presented. However, improvements in ginning services through the installation of additional equipment necessarily result in increased ginning costs, both operating and fixed. Therefore, the improvements in quality must be considered in relation to the cost of providing these improved services. With this in mind, a group of gins in the area was selected for studying the various factors affecting their cost of operation. These gins were selected on the same basis as that used in selecting those for use in the quality phase of the study and were in most cases the same gins. Cost data were obtained from 31 ginners in 1948 and 30 ginners in 1949 (Table 16). The gins were classified as standard or substandard according to the amount and type of cleaning and conditioning equipment in the gin. The cost of ginning

TABLE 16. Stratification of gins for cost study, by gin groups, and number of stands per gin, South Louisiana, seasons of 1948 and 1949

No. of Stands	Gin groups							
	Standard		Substandard with driers		Substandard without driers		All gins	
	1948	1949	1948	1949	1948	1949	1948	1949
	No.	No.	No.	No.	No.	No.	No.	No.
2	1	-	-	-	-	-	1	-
3	4	2	1	2	2	3	7	7
4	10	14	6	4	1	1	17	19
5	2	1	2	1	-	-	4	2
6	1	1	-	-	1	1	2	2
All gins	18	18	9	7	4	5	31	30

phase of this study is based on the analysis of the cost data obtained from the financial records of these gins.

Items Of Cost

The cost items were segregated into operating and fixed costs and are presented for the 1948-49 and 1949-50 seasons separately. Only those costs directly associated with ginning were included, except that no attempt was made to allocate any part of the management and office expense to other oprations engaged in by the ginner. Owing to variations in the methods used by ginners in keeping financial records, the number of categories under which costs are reported were necessarily limited to the least number used by those reporting. The items of cost presented are averages and do not necessarily mean that all gins reported costs under each item.

Operating costs are given under the following headings:

Labor: This item represents the total amount paid for labor used during the ginning season and, except for a few gins that did not separate their accounts, does not include repair labor.

Fuel: This item includes electricity, oil, natural gas or butane used for power; natural gas or butane used for drier fuel; and lubricating oil and grease. Several gins included the cost of lubricating oil and grease in miscellaneous expense.

Repairs: Repair labor, except for the gins not reporting separate labor accounts, repair materials and freight on parts are included under this item. Cost of replacements of machinery or buildings was considered as capital expenditure and was not included under repairs.

Bagging and ties: This item represents the actual cost of bagging and ties used by the gins during the season.

Manager and office salaries: This item represents the amount that was paid or withdrawn from the business for management and office salaries. For gins at which no managerial salaries were actually paid or withdrawn, the gin manager was asked to make an estimate of the amount to be charged. Since many of the gin managers also take care of the office work, these two items were combined.

Miscellaneous: All items of expense such as lights, water, heat, office supplies, advertising, publications and dues, telephone and telegraph, auditing and legal fees, entertainment for customers and other miscellaneous expenses are included under this item.

TABLE 17. Replacement value per gin, replacement value per gin stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949

No. of stands	Gin groups								All gins	
	Standard		Substandard with driers		Substandard without driers		All substandard gins			
	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand
					1948 Season					
2	$43,116	$21,558	$ -	$ -	$ -	$ -	$ -	$ -	$43,116	$ 21,558
3	48,121	16,040	44,508	14,836	43,995	14,665	44,166	14,722	46,426	15,475
4	58,057	14,514	52,078	13,020	39,944	9,986	50,345	12,586	54,881	13,720
5	60,240	12,048	51,587	10,317	-	-	51,587	10,317	55,914	11,183
6	66,174	11,029	-	-	61,072	10,179	61,072	10,179	63,623	10,604
All gins	55,713	14,326	51,128	12,437	47,251	11,813	49,935	12,248	53,290	13,431
					1949 Season					
3	49,205	16,402	41,595	14,865	42,116	14,039	43,107	14,369	44,850	14,950
4	54,102	14,458	52,109	13,027	39,944	9,986	49,676	12,419	55,686	13,922
5	56,426	11,285	49,322	9,864	-	-	49,322	9,864	52,874	10,575
6	66,174	11,029	-	-	61,072	10,179	61,072	10,179	63,623	10,604
All gins	57,259	14,119	49,564	12,850	45,473	11,966	47,859	12,485	53,499	13,487

Fixed costs are given under the following headings:

Depreciation: Depreciation was calculated at 5 per cent of the replacement value for all machinery, 5 per cent for all-wood buildings, 4 per cent for wood-frame-steel buildings, and 3 per cent for all-steel buildings. Replacement values were based upon 1948 gin prices, and installation and material charges.

Interest on investment: Allowance was made for interest on investment at 4 per cent of the present value of the gin plants. Present values were determined by making adjustments in the replacement value on the basis of appraisals made of the gin plants.

Taxes: This item represents the amount paid for municipal, county and state property taxes, corporation taxes and license fees.

Insurance: This item includes insurance premiums of all kinds, such as fire, tornado, flood, fire insurance on cotton and cottonseed and workman's compensation insurance.

Investment in Ginning Industry

The average replacement value per gin for all gins included in the study was $53,290 and $53,499 or on a per stand basis $13,431 and $13,487 for the 1948 and 1949 seasons, respectively (Table 17). These values represent the amount it would cost to replace these gins on the basis of 1948 gin prices and installation and material changes. The slight change in replacement value between the two years was due to the inclusion of different gins in the study during 1949 rather than to changes in values of the individual gins. Replacement values were greatest for those gins having the largest number of stands and were progressively lower as the number of stands was reduced. The value per stand, however, decreaed as the number of stands increased owing to the fact that the investment in gin equipment other than the gin stand itself does not increase proportionately as additional stands are added. During 1948 the average replacement value for standard gins was $55,713 compared to $49,935 for substandard gins or on a per stand basis $14,326 and $12,248, respectively. Since the average number of stands per gin was approximately the same for the two groups of gins, the difference in replacement values was due almost entirely to the amount and type of cleaning and conditioning equipment installed in the gins.

In 1948 the present value per gin for standard gins amounted to $36,342 compared to $23,318 for substandard gins or on a per gin stand basis $9,345 and $5,719, respectively (Table 18). The normal reduction in present values due to annual depreciation is not re-

TABLE 18. Present value per gin, present value per gin stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949

No. of stands	Gin groups								All gins	
	Standard		Substandard with driers		Substandard without driers		All substandard gins			
	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand	Per gin	Per stand
					1948 Season					
2	$ 24,425	$ 12,212	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,425	$ 12,212
3	24,890	8,297	17,204	5,735	19,025	6,342	18,418	6,139	22,116	7,372
4	42,865	10,716	27,081	6,770	17,047	4,262	25,647	6,412	35,775	8,944
5	68,373	13,675	19,378	3,876	-	-	19,378	3,876	26,782	5,356
6	33,148	5,525	-	-	29,586	4,931	29,586	4,931	31,367	5,228
All gins	36,342	9,345	24,272	5,904	21,171	5,293	23,318	5,719	30,880	7,783
					1949 Season					
3	18,112	6,037	23,377	7,792	15,233	5,078	18,490	6,163	18,382	6,127
4	43,725	10,931	24,205	6,051	15,143	3,786	22,392	5,598	38,111	9,528
5	18,727	3,745	17,176	3,495	-	-	17,176	3,495	18,102	3,620
6	30,009	5,002	-	-	26,722	4,454	26,722	4,454	28,366	4,728
All gins	38,728	9,549	23,007	5,965	17,513	4,609	20,034	5,226	31,524	7,947

flected in the values for 1949 because of the fact that different gins were included in the study and additions to capital investment were made by some gins between the two years. The present values used represent adjustments made in the replacement values based upon appraisals of the gin plants. The difference in present values between the two groups is due to differences in the age of the gins and equipment as well as to the amount and type of cleaning and conditioning equipment installed in the gins. The present value of standard gins in 1948 represents 65 per cent of their replacement value compared to only 47 per cent for substandard gins, indicating that the standard gins were built more recently.

The replacement and present values per gin for both groups of gins were not exceptionally large; however, owing to the small volume of cotton ginned these values when computed on a per bale ginned basis were relatively high (Table 19). Replacement and present values per bale ginned were considerably higher during 1949 for both groups than in 1948 The necessity of considering the volume of cotton to be ginned in relation to the investment to be made in the gin is evident. Larger volumes reduce the investment per bale which in turn results in lower per bale depreciation and interest on investment costs and consequently significantly lower total per bale costs.

TABLE 19. Replacement value and present value per bale ginned, by gin groups, South Louisiana, seasons of 1948 and 1949

Gin group•	Season			
	1948		1949	
	Replacement Value	Present Value	Replacement Value	Present Value
Standard gins	$35.68	$ 23.28	$46.65	$31.45
Substandard gins	37.82	17.66	62.31	26.97
All gins	36.49	21.15	51.45	30.08

Comparative Cost of Ginning by Gin Groups

The average cost of ginning during the 1948 season was $16,084 for standard gins, $13,708 for substandard, and $15,088 for all gins or on a per bale basis $10.30, $10.38, and $10.33, respectively (Table 20). A similar relationship between the groups existed during 1949, although per bale costs were higher by $1.78 at standard gins, $3.84 at substandard gins, and $2.41 for all gins (Table 21). The higher per bale costs during 1949 were due to lower volumes of cotton ginned

TABLE 20. Distribution of ginning costs by gin groups, South Louisiana, season 1948-1949

Items of Cost	Standard gins			Substandard gins			All gins		
	Cost Per gin	Cost Per bale	Percent of total	Cost Per gin	Cost Per bale	Percent of total	Cost Per gin	Cost Per bale	Percent of total
	Dollars	Dollars	Percent	Dollars	Dollars	Percent	Dollars	Dollars	Percent
Operating costs:									
Labor	3,433	2.20	21	3,140	2.38	23	3,310	2.27	22
Fuel - drier and power	1,020	.65	6	877	.66	7	960	.66	6
Repairs	1,055	.67	7	1,082	.82	8	1,066	.73	7
Bagging and ties	3,688	2.36	23	3,139	2.38	23	3,457	2.37	23
Manager and office salaries	1,466	.94	9	1,007	.76	7	1,274	.87	9
Miscellaneous	486	.31	3	432	.33	3	463	.32	3
Total operating costs	11,147	7.14	69	9,676	7.33	71	10,530	7.21	70
Fixed costs:									
Depreciation	2,684	1.72	17	2,408	1.82	18	2,568	1.76	17
Interest on investment	1,472	.94	9	933	.71	7	1,246	.85	8
Taxes	286	.18	2	257	.19	2	273	.19	2
Insurance	495	.32	3	435	.33	3	470	.32	3
Total fixed costs	4,937	3.16	31	4,032	3.05	29	4,558	3.12	30
Total costs	16,084	10.30	100	13,708	10.38	100	15,088	10.33	100
Bales ginned (av.)		1,561			1,320			1,460	

TABLE 21. Distribution of gin costs by gin groups, South Louisiana, season 1949-50

Items of cost	Standard gins			Substandard gins			All gins		
	Cost per gin	Cost per bale	Percent of total	Cost per gin	Cost per bale	Percent of total	Cost per gin	Cost per bale	Percent of total
	Dollars	Dollars	Percent	Dollars	Dollars	Percent	Dollars	Dollars	Percent
Operating costs:									
Labor	2,939	2.54	21	2,565	3.34	23	2,790	2.78	22
Fuel - drier and power	821	.71	6	428	.56	4	664	.66	7
Repairs	887	.77	6	794	1.03	7	850	.85	5
Bagging and ties	2,845	2.46	20	1,801	2.34	17	2,428	2.42	19
Manager and office salaries	1,077	.93	8	771	1.00	7	954	.95	7
Miscellaneous	447	.39	3	673	.88	6	537	.54	4
Total operating costs	9,016	7.78	64	7,031	9.15	64	8,222	8.20	64
Fixed costs:									
Depreciation	2,709	2.34	19	2,303	3.00	21	2,547	2.54	20
Interest on investment	1,549	1.34	11	829	1.08	8	1,261	1.26	10
Taxes	223	.19	2	220	.29	2	222	.22	2
Insurance	501	.43	4	543	.71	5	518	.52	4
Total fixed costs	4,983	4.30	36	3,894	5.07	36	4,548	4.54	36
Total costs	13,999	12.08	100	10,926	14.22	100	12,770	12.74	100
Bales ginned (av.)		1,159			709			1,002	

and the nature of the two harvesting seasons. The 1948 season was above normal for the area in that production was high and the harvesting season was exceptionally dry and of short duration. The 1949 season was more nearly normal for the area, having considerable rainfall during the harvesting season which prolonged its duration, and production was below that of 1948.

During 1948 the most important item of expense for standard gins was bagging and ties, representing 23 per cent of total costs and was followed by labor and depreciation, representing 21 and 17 per cent, respectively. Bagging and ties and labor each represented 23 per cent of total costs for substandard gins, with depreciation accounting for 18 per cent. Labor was the most important item of cost for both groups of gins during 1949. The rank of these items of cost as to their importance in relation to total costs depends primarily upon the volume of cotton ginned. At the higher volumes, bagging and ties tend to account for an increasing proportion of total cost, and as volume decreases, first labor and then depreciation represents the larger proportion. The average volume ginned was lower at substandard gins than at standard gins and was considerably lower for both groups of gins in 1949 than in 1948.

Other important items of expense were management and office salaries and interest on investment, each representing 9 per cent of total cost at standard gins and 7 per cent at substandard gins in 1948. Fuel and repair costs together represented 13 and 15 per cent of total costs for standard and substandard gins, respectively.

As has been previously pointed out, the depreciation and interest on investment items of cost were calculated on the basis of 1948 gin prices, and installation and material charges and do not represent the actual cost of these items as carried on the financial records of the gins surveyed. These amounts as used represent the costs that would be incurred by the gins if replaced at present-day prices. The actual depreciation charged by the gins ranged from no charge at the older gins which had been fully depreciated to approximately $1,800 on the more recently built gins. Actual depreciation cost during 1948 averaged $0.81 per blae for standard gins, $0.49 for substandard gins and $0.64 for all gins, or 47, 27, and 36 per cent of the calculated costs for the three groups, respectively. Interest on investment would likewise be somewhat smaller if calculated upon the basis of the actual investment in the gin rather than on the basis of 1948 gin prices, and installation and material charges.

Operating costs per bale were higher at substandard gins than

TABLE 22. Total ginning cost per bale, operating cost per bale, fixed cost per bale, and number of bales ginned per stand, by gin groups and number of stands, South Louisiana, seasons of 1948 and 1949

Number of stands	Gin groups											
	Standard				Substandard				All gins			
	Volume per stand	Operating cost per bale	Fixed cost per bale	Total cost per bale	Volume per stand	Operating cost per bale	Fixed cost per bale	Total cost per bale	Volume per stand	Operating cost per bale	Fixed cost per bale	Total cost per bale
	Number	Dollars	Dollars	Dollars	Number	Dollars	Dollars	Dollars	Number	Dollars	Dollars	Dollars
						1948 Season						
2	900	5.84	2.44	8.28	-	-	-	-	900	5.84	2.44	8.28
3	379	8.17	3.55	11.72	340	7.65	3.31	10.96	362	7.96	3.45	11.41
4	439	6.24	2.93	9.17	279	6.95	3.63	10.58	373	6.46	3.14	9.60
5	232	11.73	4.74	16.47	298	8.83	2.93	11.76	265	10.10	3.73	13.83
6	313	8.66	3.17	11.83	554	6.58	1.57	8.15	433	7.33	2.15	9.48
All gins	401	7.14	3.16	10.30	324	7.33	3.05	10.38	368	7.21	3.12	10.33
						1949 Season						
3	302	7.56	3.83	11.39	213	9.87	5.48	15.35	238	9.04	4.88	13.92
4	307	7.39	4.28	11.67	183	9.63	5.57	15.20	274	7.78	4.50	12.29
5	192	10.32	4.11	14.43	107	9.66	7.40	17.06	150	10.09	5.28	15.37
6	152	12.87	5.93	18.80	306	6.83	2.67	9.50	229	8.84	3.76	12.60
All gins	286	7.78	4.30	12.08	200	9.15	5.07	14.22	253	8.20	4.54	12.74

at standard gins for both years of the study. Operating costs represented 69 per cent of total costs for standard gins and 71 per cent for substandard gins during 1948 compared to 64 per cent for both groups in 1949. Fixed costs per bale were higher at standard gins than at substandard gins during 1948, but were lower in 1949. As indicated previously, there was a considerably greater difference in the volume of cotton ginned by the two groups of gins during 1949 than in 1948, which accounts for this relationship.

Total costs per bale, for plants of similar size having approximately the same volume of cotton, were higher for the standard gins than for the substandard gins during 1948, and a similar relationship existed during 1949 (Table 22). Both operating and fixed costs were higher for the standard gins than for the substandard gins. The higher operating costs may be attributed to increases in such items of expense as managerial and office salaries, fuel for power and driers, and miscellaneous expenses. A large proportion of the standard gins had hired managers, most of whom were paid on a flat per bale basis, whereas most of the substandard gins were operated by owner-managers. All standard gins were equipped with driers, whereas several substandard gins were not. Because of the relative difference in the amount and type of conditioning and cleaning equipment, standard gins generally required larger power plants and consequently used more fuel for these units and for driers. The difference in per bale fixed costs are attributed almost entirely to the relatively larger investment in cleaning and conditioning equipment and to the differences in the age of the gin plants reflected in the form of higher depreciation and interest on investment charges. The necessity of larger per stand volumes at standard gins to offset the increased costs incurred in providing improved ginning services through the installation of additional equipment is evident in the comparison of the per bale costs of the two groups of gins.

There was a direct relationship between the volume ginned per stand and the per bale costs at both standard and substandard gins during 1948 and 1949 (Table 23). Costs were higher for standard gins than for substandard gins at all comparable volume ranges during both years except in the 200-299 range during 1949. This was due to one of the substandard gins having an exceptionally large per bale operating cost which resulted in the substandard gins in this volume range having a higher per bale cost than standard gins. The greatest reduction in cost occurred up to the 300-bale per stand volume range;

TABLE 23. Total cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949

Volume per stand	Season					
	1948			1949		
	Standard	Sub-standard	All Gins	Standard	Sub-standard	All Gins
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
700 and above	7.18	-	7.18	-	-	-
500 - 699	-	8.40	8.40	9.05	-	9.05
400 - 499	10.04	9.39	9.88	9.94	-	9.94
300 - 399	11.05	10.12	10.58	11.20	10.89	11.09
200 - 299	13.71	11.99	12.86	12.49	16.09	13.95
Below 200	16.72	13.21	14.68	17.45	15.46	16.55
All gins	10.30	10.38	10.33	12.08	14.22	12.74

from this point on reductions were at a smaller rate. A similar relationship was noted between the volume ginned per gin and the cost per bale (Table 24).

TABLE 24. Total cost per bale, by gin groups and volume per gin, South Louisiana, seasons of 1948 and 1949

Volume per gin	Season					
	1948			1949		
	Standard	Sub-standard	All Gins	Standard	Sub-standard	All Gins
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
2000 and above	6.86	8.15	7.31	9.05	-	9.05
1500 - 1999	9.82	9.47	9.72	9.91	9.50	9.82
1000 - 1499	12.08	10.82	11.39	12.11	13.21	12.46
750 - 999	13.07	12.48	12.89	14.49	15.64	14.94
Below 750	14.68	14.22	14.46	19.55	15.94	16.89
All gins	10.30	10.38	10.33	12.08	14.22	12.74

Fixed and Operating Costs

Fixed Costs—There was a direct relationship between ginning volumes per gin stand and fixed costs per bale for standard gins and substandard gins in both 1948 and 1949 (Table 25). Because of increased capital investment, the standard plants incurred higher fixed costs than substandard gins at any given volume except in the 200-299 range during 1949, where the relationship was obscured by too few cases among the standard gins in this group. In 1948 fixed costs ranged from a high of more than $7.00 per bale for standard gins operating at volumes below 200 bales per gin stand, downward to $2.08 per bale for those handling above 700 bales per stand. This compares with a range of more than $5.00 downward to less than

$1.62 per bale for comparable volumes for substandard gins. Since substandard gins generally contained a smaller amount of conditioning and cleaning equipment, fixed costs were much less, the result being that per bale costs were also significantly reduced.

At the lower volume ranges, fixed cost per bale decreased at a greater rate for standard gins than for substandard gins. The difference tended to become more stabilized at the higher volume ranges, the result being that any further increase in volume caused about the same decrease in fixed cost per bale for gins in each group.

TABLE 25. Fixed cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949

Volume per stand	Season					
	1948			1949		
	Standard	Sub-standard	All Gins	Standard	Sub-standard	All Gins
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
700 and above	2.08	-	2.08	-	-	-
500 - 699	-	1.62	1.62	3.31	-	3.31
400 - 499	2.74	2.37	2.65	3.01	-	3.01
300 - 399	3.43	2.69	3.05	3.54	2.84	3.29
200 - 299	4.60	4.09	4.35	4.84	5.28	5.02
Below 200	7.29	5.48	6.24	7.01	6.99	7.02
All gins	3.16	3.05	3.12	4.30	5.07	4.54

It has been observed that the investment per bale ginned was extremely high for both groups of gins in the area. Because of the low volumes ginned by both groups, fixed charges such as depreciation and interest on investment constitute a relatively large part of total cost for both groups of gins. Since successive increases in volume result in proportionate decreases in fixed costs it is essential that gins in the area have adequate ginning volumes. Because of the increased investment in standard gins, increases in volumes are even more important for these gins to offset their increased costs.

Operating Costs—Increased volumes of ginning per stand caused decreases in operating costs per bale for both groups of gins (Table 26). At any given volume range, per bale operating costs were higher at standard gins than at substandard gins except during 1949, when the substandard gins were higher owing to two gins having abnormally high labor cost. However, at the lower volume ranges operating costs tended to decrease at a greater rate for standard gins than for substandard gins and the difference in operating costs between the two groups tended to become progressively smaller with each succeeding increase in volume.

TABLE 26. Operating cost per bale, by gin groups and volume per stand, South Louisiana, seasons of 1948 and 1949

Volume per stand	Season					
	1948			1949		
	Standard	Substandard	All Gins	Standard	Substandard	All Gins
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
700 and above	5.11	-	5.11	-	-	-
500 - 699	-	6.78	6.78	5.74	-	5.74
400 - 499	7.39	7.02	7.30	6.93	-	6.93
300 - 399	7.62	7.43	7.53	7.66	8.05	7.80
200 - 299	9.11	7.90	8.51	7.65	10.81	8.93
Below 200	9.43	7.73	8.44	10.41	8.47	9.53
All gins	7.14	7.33	7.21	7.78	9.15	8.20

One of the more important items of operating expenses for both groups of gins was labor. Since, as pointed out previously, labor costs accounted for about 21 per cent and 23 per cent of total cost for standard and substandard gins, respectively, it is obvious that the handling of adequate volumes is essential if labor is to be used most effectively and unit costs are to be reduced for this item. Increased volumes would also make it possible for a more continuous use to be made of gin capacity, increasing efficiency in the use of the power plant and lowering fuel cost.

The relationship of fixed and operating costs to total costs depends primarily upon the volume of cotton ginned. At low volume ranges fixed costs constitute a larger part of total cost than they do at the higher volumes. Operating cost, on the other hand, constitutes a major part of total cost at the higher volumes and a smaller part at low volumes (Table 27). The immediate effect of increased volumes is reflected in a reduction of the fixed cost per bale. Any further reduction in total costs after high volumes have been attained must be achieved through more efficient use of labor, power, and materials, those cost items which constitute operating costs.

Effect of Volume and Size of Plant on Ginning Costs

There was a direct relationship between the size of plant or number of gin stands, volume of ginning and total costs per bale (Table 28). All size groups showed reductions in per bale cost as volumes increased; however, there were significant differences in the costs for gins of varying size that ginned similar volumes. The total costs per bale for similar volumes increased progressively as the size of the gin plant increased. Five-stand outfits ginning approximately the same volume of cotton as 4-stand gins, incurred costs of

TABLE 27. Operating cost per bale, fixed cost per bale and total cost per bale, by gin groups and volume per stand, South Louisiana, 2-year average, 1948 and 1949

Volume per stand	Gin Groups								
	Standard			Substandard			All gins		
	Operating	Fixed	Total	Operating	**Fixed**	Total	Operating	Fixed	Total
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
900 and above	5.84	2.45	8.29	-	-	-	5.84	2.45	8.29
800 - 899	4.56	2.10	6.66	-	-	-	4.56	2.10	6.66
700 - 799	5.27	1.82	7.09	-	-	-	5.27	1.82	7.09
500 - 699	5.74	3.31	9.05	6.58	1.57	8.15	6.26	2.23	8.49
400 - 499	7.24	2.83	10.07	7.02	2.37	9.39	7.20	2.74	9.94
300 - 399	7.64	3.49	11.13	7.68	2.75	10.43	7.66	3.17	10.83
200 - 299	8.33	4.73	13.06	9.20	4.62	13.82	8.72	4.68	13.40
Below 200	10.14	7.11	17.25	8.18	6.40	14.38	9.17	6.76	15.93
All gins	7.41	3.65	11.06	7.97	3.76	11.73	7.61	3.69	11.29

$3.43 per bale higher than did 4-stand gins. At the average volumes obtained by gins included in this study, it is evident that the smaller gins usually operated more efficiently with regard to the utilization of optimum capacity than gins containing five or more stands.

TABLE 28. Total cost of ginning per bale, by size of gin plant and ginning volume, South Louisiana, 2-year average, 1948 and 1949

Size of gin and volume ginned	Gins per group	Volume per gin	Cost per bale
	Number	Bales	Dollars
2-stands:			
Bales ginned:			
Above 1500	1	1800	8.28
3-stands:			
Bales ginned:			
Below 750	5	505	14.44
750-1500	9	1121	11.90
All 3-stand gins	14	901	12.41
4-stands:			
Bales ginned:			
Below 750	6	581	16.89
750-1500	18	1029	12.17
Above 1500	12	2015	8.90
All 4-stand gins	36	1283	10.81
5-stands:			
Bales ginned:			
Below 750	1	534	17.06
750-1500	4	1072	15.60
Above 1500	1	1971	10.26
All 5-stand gins	6	1132	14.17
6-stands:			
Bales ginned:			
750 - 1500	1	914	18.80
Above 1500	3	2345	9.48
All 6-stand gins	4	1987	10.55

As indicated previously, increased volumes of ginning have a direct effect on reducing some items of cost, thereby lowering total costs. Costs were higher by approximately $8.00 per bale for 4-stand gins ginning volumes below 750 bales per gin as compared to 4-stand gins having volumes above 1,500 bales per gin.

In view of the relationship of ginning volume and size of plant to ginning costs, it is essential that gin owners carefully weigh any projected capital outlay against anticipated ginning volumes before building large new plants or enlarging present facilities.

GINNING REVENUE

Income received by gins in South Louisiana in 1948 and 1949 was derived principally from charges made for ginning, the sale of bagging and ties, and transactions involving the sale of cotton and cottonseed that had been purchased by the gin from the producer. In addition the gins derived a small income from such activities as handling planting seed and fertilizer. Since this study is concerned with the cost of operating the gin itself, only that income derived from charges made for ginning and the sale of bagging and ties is included in this report.

The predominant method of assessing ginning charges was on the basis of a flat rate per hundred pounds of lint cotton including the weight of the bagging and ties. The gins included in the study usually charged $1.25 per hundred weight of lint cotton for ginning, in addition to a charge of $3.25 per bale for bagging and ties. These rates were the same at virtually all of the gins, both standard and substandard, and were approximately the same during both 1948 and 1949. The rates bear no relation to the quality of the gin service and only an indirect relation to the cost of ginning. They are generally determined by competition between gins in the area and in relation to ginner trade practices, such as the methods used in buying cottonseed and lint cotton and the margins taken for handling these products. The average ginning revenue received by all gins amounted to $9.82 per bale during 1948 and $10.03 per bale during 1949. Standard gins received a somewhat smaller revenue than substandard gins during 1948, $9.74 compared to $9.94, and slightly more than substandard gins during 1949, $10.08 compared to $9.95. The difference in average revenue per bale was due to variations in the average weight of the bales ginned by the two groups of gins.

CONCLUSIONS AND RECOMMENDATIONS

The standard or modern cotton gins in South Louisiana are equipped with an 11-shelf tower drier and auxiliary cleaning equipment which consists of either a cylinder cleaner or large extractor feeders. The older and more obsolete plants are equipped with drum feeders, approximately 17 per cent have no drying facilities, and none are equipped with any overhead cleaning equipment.

The most important single factor adversely affecting the value of cotton produced in South Louisiana is the reduction in grade caused by rough ginning preparation. In recent years as much as 40 per cent of the crop has been reduced one or more grades because of poor ginning.

The amount of moisture present in seed cotton as it arrives at the gin is directly related to rough ginning. During the dry season of 1948, approximately 60 per cent of the crop was brought to all gins in such condition that drying was essential prior to ginning, as compared with over 90 per cent during the normal season of 1949. There was little or no difference in the moisture content of seed cotton delivered to the different groups of gins in either 1948 or 1949.

During the 1948 ginning season, gins not using driers produced lint having an average seasonal moisture content of 9.6 per cent as compared with 7.1 per cent for gins equipped with driers. The lower lint moisture content of cotton ginned at plants equipped with driers is reflected in a smaller proportion of ginnings which were reduced one or more grades because of rough preparation.

In 1949, the removal of a sufficient amount of moisture to insure smooth ginning of all cotton was not accomplishd by any of the gins. Standard gins employing driers reduced the lint moisture content on almost one-half of their ginnings to 7 per cent, which is considered desirable for good ginning. This compares to only one-fourth of the ginnings for substandard plants using driers and none for those plants not equipped with driers. Approximately one-fifth of the ginnings for standard plants were reduced in grade because of rough preparation for the season as compared to one-fourth for the substandard gins with driers and over one-half of the ginnings for the substandard plants not equipped with any drying devices.

Only 3 per cent of the cotton from all gins was reduced in grade because of rough preparation when the moisture content of the ginned lint was below 6 per cent. On the other hand, approximately three-fourths of the ginnings were reduced in grade because of this factor when the lint moisture content was 12 per cent or more. For the normal lint moisture range of 6.0 to 6.9 per cent, 13 per cent of the ginnings were reduced in grade because of rough gin preparation. This relatively higher proportion of rough ginning for a moisture range conducive to smooth ginning suggests that factors other than moisture are partly responsible for rough preparation in the area. Specifically, heavy weevil infestation and the harvesting of partially opened green bolls causes lint to be rough in appearance. Producers may decrease the incidence of rough preparation by picking only fully opened bolls and by use of defoliants to increase the rate of opening during the years when plant growth is above average. The employment of additional drying and cleaning equipment by ginners to provide an opening action on seed cotton would also aid in reducing loses incurred through rough preparation.

Although standard gins received cotton containing considerably more foreign matter than either group of the substandard gins, cleaning and drying action was such that the foreign matter content of the seed cotton after cleaning was lower at the better equipped gins. In 1948, standard gins obtained lint equivalent in value to Middling from seed cotton containing an average of 1.5 per cent foreign matter, while the substandard plants required seed cotton containing an average of 1.2 per cent foreign matter to produce lint of equivalent value. All gins were less efficient in the removal of foreign matter in 1949, which illustrates the necessity of adequately drying seed cotton before maximum benefits of the cleaning equipment can be realized.

During the relatively dry season of 1948, average grade differences by the various groups of gins were small and insignificant. On the other hand, during the rainy season of 1949, the seasonal average grades obtained at standard gins were approximately one-third grade higher than cotton ginned at the substandard plants. If all gins had received seed cotton containing equal amounts of foreign matter, more pronounced grade differences in favor of the better equipped gins would have been in evidence for both years.

Based on the Government loan prices applicable at Opelousas, Louisiana, for 1-1/16 inch cotton in 1949, the seasonal average value per bale for standard gins was $1.08 higher than for cotton ginned at substandard gins with driers, and $2.50 higher than for cotton ginned at substandard gins without driers. By adjusting bale values to measure the loss in value due to rough preparation alone, it was found that the standard gins incurred a seasonal loss of $2.31 per bale as compared with $3.33 per bale for substandard gins employing driers and $5.67 per bale for substandard gins without driers. The average loss in value because of rough preparation for early season cotton ginned at standard plants was approximately $14 per bale. It is significant that approximately one-half of these bales were passed through the driers twice. This illustrates the necessity for better harvesting practices in the area, including sun and storage drying on the farm before attempting to gin such cotton.

Producers who follow the practice of ginning wet seed cotton at plants with no drying equipment sometimes gain as much as 20 pounds of weight per bale as compared with similarly conditioned cotton ginned at plants equipped with the conventional 11-shelf tower drier found in the area. However, when lint cotton contains an excessive amount of moisture, a corresponding amount of lint, by weight, is usually left on the seed in the ginning process and the net turnout is not affected to any appreciable extent. The effect of additional weight gained through excess lint moisture is reflected in lower average prices being paid by buyers for such cotton, as it is generally understood that such lint cotton will lose a considerable part of this weight during storage and shipment to the mills. Thus, all producers in the area are usually penalized and no real gains result to them as a group.

The average replacement value for standard gins in 1948 was $55,713 compared to $49,935 for substandard gins. The difference in values was due almost entirely to the amount and type of cleaning and conditioning equipment installed in the two groups of gins. On a per bale ginned basis the present values for both groups of gins were relatively high, indicating the need for larger gin volumes in the area.

The average cost per bale for ginning during 1948 was $10.30 for standard gins and $10.38 for substandard gins at average volumes of 1,561 and 1,320 bales, respectively. Per bale costs were higher by $1.78 per bale for standard gins and $3.84 for substandard in 1949 owing to lower volumes and a prolonged ginning season. Operating costs constituted the major part of total cost for both groups of gins during 1948 and 1949. The most important item of expense during 1948 was bagging and ties; however, because of lower volumes ginned labor represented a larger part of total cost in 1949.

There was a direct relationship between the volume ginned per stand and the per bale costs for both standard and substandard gins. Total costs, however, were higher for standard gins than for substandard gins of similar size ginning approximately the same volume of cotton. The greatest reduction in cost occurred up to the 300 bale per stand volume range. Beyond this point reductions were at a slower rate.

There was a direct relationship between ginning volumes per gin stand and fixed costs per bale for both groups of gins. Owing to increased capital investment, the standard gins incurred higher fixed costs than substandard gins at any given volume. At the lower volume ranges, fixed cost per bale decreased at a greater rate for standard gins than for substandard gins. However, the differences tended to become more established at the higher volume ranges.

Fixed costs per bale were relatively high for both groups of gins owing to the small volumes ginned. Since successive increases in volumes result in proportionate decreases in fixed costs, it is essential that gins in the area obtain adequate ginning volumes.

Increased volumes of ginning per stand caused decreases in operating costs per bale for both groups of gins. At any given volume range, per bale operating costs were higher at standard gins than at substandard gins. However, at the lower volume ranges they tended to decrease at a greater rate for standard gins. Increased volumes made it possible for more continuous use to be made of gin capacity, which results in increased efficiency in the use of labor and the power plant and consequently lower labor and fuel costs.

There was a direct relationship between the size of plant, volume of cotton ginned, and ginning cost per bale. All size groups showed reductions in per bale costs as volumes increased. However, there were significant differences in the cost for gins of varying size that ginned similar volumes. In view of this relationship it is essential that gin owners carefully weigh any projected capital outlay against anticipated ginning volumes before building large new plants or enlarging present facilities.

The cost of ginning incurred by standard gins was higher than that incurred by substandard gins at all comparable volume ranges because of additional facilities provided by them. The increased cost ranged from $0.30 to $3.50 per bale, depending upon the volume of cotton ginned. However, because of the larger volumes ginned by standard plants, they were able to more than offset these additional costs and operated as a group at somewhat lower cost than did the substandard gins. These gins, through the use of drying facilities and auxiliary cleaning equipment, produced lint with a seasonal average value per bale of $2.50 higher than cotton ginned at substandard plants and maintained volumes large enough to offset the cost involved in providing the additional services.

Income received by gins in South Louisiana was derived principally from charges made for ginning, the sale of bagging and ties, and transactions involving the sale of cotton and cottonseed purchased from the producer. The gins generally charged $1.25 per hundredweight of lint, including the weight of bagging and ties, in addition to a charge of $3.25 per bale for bagging and ties. The rates bear no relation to the quality of the gin service and only an indirect relation to the cost of ginning. The average ginning revenue received by gins from this source amounted to $9.82 per bale during 1948 and $10.03 in 1949.

The results of the study emphasize the necessity for adequate drying capacity in this area. Every gin should be equipped with a 24-shelf tower drier or its equivalent in drying capacity. Gins that handle appreciable amounts of green, very damp cotton should also have for use on this cotton an additional drier or at least an additional heater for applying heat to the seed cotton in the overhead cleaners or feeders, depending on the equipment in use. From a cleaning standpoint, gins should be equipped with modern huller front gin stands, extractor feeders or multiple unit extractors, and one overhead cleaner. Drying and cleaning combinations of this type could perform a creditable job of ginning on most of the cotton harvested in the area at present. A limited number of elaborately equipped plants centrally located throughout the area to handle effectively wet early season and late season roughly harvested cotton would probably prove to be advantageous to the cotton industry in the area. However, potential benefits from drying, cleaning, and extracting cannot be fully realized unless timely repairs and replacements of saws, ribs, and the doffing mechanism of the gin stands are made, and unless the producer and management insist upon operating practices that insure loose seed rolls which are basic to smooth ginning.

The results of the study indicate that gin owners who make improvements in their ginning facilities can expect to offset all or part of their additional cost through increases in volume due to new customers attracted to the gin by improved services and increased bale values. However, because of excessive gin capacity available in the area, it is highly improbable that all of the small obsolete substandard gins can increase their volumes sufficiently to offset the added cost of modernizing these plants. Therefore, from the standpoint of the area as a whole, it would be preferable that the older, more obsolete gins be dismantled, thereby increasing the volumes of the remaining gins to the extent that they may make needed improvements. Gin owners, especially those who own more than one plant, operating plants with small volumes should consider consolidating their operations into one modern gin instead of operating individual obsolete gins and thereby increase volumes sufficiently to offset the cost of modernizing the remaining plants.

Results of the study emphasize the need for additional volumes of cotton by both groups of gins in South Louisiana to obtain more efficient utilization of present ginning capacity and to decrease overhead cost. Since increased volumes reduce cost largely in terms of fixed costs, it is also important that gin operators be on the alert to take advantage of every possible means to reduce operating costs through more efficient operation. Since labor accounts for such an important part of operating costs, efficient use of a small, competent well-trained labor force will do much to reduce this item of expense. Most gins in the area had larger labor forces than needed for efficient operation. Operators can also make more efficient use of machinery and equipment and thereby reduce power and repair costs.

Roses For The Yard

By

R. H. HANCHEY and W. D. KIMBROUGH

The Peace Variety

L. S. U.
Library
La. Coll.

uisiana Bulletin No. 451

June, 1951

LOUISIANA STATE UNIVERSITY
and
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. Taggart, Director

ROSES FOR THE YARD

R. H. HANCHEY and W. D. KIMBROUGH

INTRODUCTION

There is no doubt that the rose is the most universally popular flower grown. There are many other beautiful flowers, such as the camellia, gladiolus, iris, lily, narcissus and several other ornamental plants, that have many followers, but none is a real rival of the rose. The fact that some kind of rose can be grown in most localities where any plant will thrive accounts for much of its widespread popularity. Its wide range of types and colors, pleasing fragrance and unsurpassed beauty as a cut flower usually give it first consideration as a flower to plant in home gardens. Here in the deep South it is possible to have roses in bloom in the open for a period of eight to nine months in a year. While the rose is generally grown as a cut flower, some types may be worked into a planned landscape. As the rose plant is a perennial, a rose bed properly cared for should be satisfactory for a number of years.

There is very little experimental information concerning the culture of roses in this area, but it is very much needed and desired. In general it has been believed that only a few varieties of roses could be successfully grown by the average person in south Louisiana. Many more people would grow roses if they could expect to grow satisfactorily some of the newer more prized varieties. Experimental work was started with roses at the Louisiana Agricultural Experiment Station in January, 1949. Many years must often pass before sufficient data for making recommendations can be accumulated. Because of the great demand for information concerning rose culture, it is the purpose of this bulletin to give helpful information to those interested in growing roses under Louisiana conditions. The information is based on observations and experimental work done here and elsewhere.

ROSE CLASSIFICATION

The average rose grower considers all roses as being either bush or climbing types. There are, however, several classes of roses, some being satisfactory and some unsatisfactory as a group, but having individual varieties of special merit within the group. Bush roses are generally divided into the following classes: Hybrid Teas, Hybrid perpetuals, Teas, Polyanthas, Hybrid Polyanthas (Floribundas), Tree or Standard, and Miniature.

Hybrid Teas

Varieties of this class are of relatively recent origin and are the result of crosses between tea roses and hybrid perpetuals. This group is of far more importance than the other groups, as it contains most of the varieties commonly grown now. Practically all greenhouse roses sold by florists are of the hybrid tea group. They are classified as continuous bloomers, which means they bloom in cycles until stopped by unfavorable environmental conditions such as cold weather. The growth habits of the different varieties in this group vary, but generally speaking they range in height from two to six feet, with most being intermediate. They vary in form from the sprawling type of growth made by varieties like Crimson Glory to the upright growth of varieties like Texas Centennial. The foliage varies in color from the light green of Talisman to the dark green of Peace. Flower form may vary from the delicate single blossom of Dainty Bess to the full double of Briarcliff. Many of the hybrid teas are fragrant; others are not. Hybrid teas as a group are recurrent bloomers and are fairly vigorous growers.

Hybrid Perpetuals

The word perpetual in this case is very misleading. The hybrid perpetuals as a group are not perpetual bloomers. During the time when they were most popular they came nearer to being perpetual bloomers than other types grown at that time. As a group they are of little importance today. American Beauty and Ulrich Brunner are varieties of this group. The variety Frau Karl Druschki is a hybrid perpetual and probably the best white variety for growing in Louisiana. The group as a whole grows vigorously and makes a stiff, upright type of growth and has dull green leaves and very double and somewhat flat blooms. They may or may not be fragrant.

Polyanthas

Plants of this group seldom grow over two feet in height. The flowers are small in size and borne in clusters. Fragrance is lacking in many varieties. Cecile Brunner (Sweetheart rose) and George Elger are examples of this group. This group is gradually being replaced by the hybrid polyanthas or floribundas.

Hybrid Polyanthas (Floribundas)

This class probably ranks second to the hybrid teas in importance at the present time. As a group they are similar to the true polyantha but individual plants attain greater size. The blooms are borne in clusters but are generally larger than those of the polyantha, and some floribunda varieties have less flowers per cluster. This is an important group of roses but cannot compare with the hybrid teas as a source of cut flowers or for exhibition purposes.

Tree or Standard

Very few tree roses are grown in Louisiana. Many people dislike the constant pruning that is necessary to keep the top of a tree rose in a pleasing shape and the staking of plants which is essential for their support. A tree or standard rose can be any variety of bush rose. Hybrid teas and floribundas are probably used most. A tree rose is produced by selecting a straight-stemmed cane and placing one or two buds of the desired variety in it two to to six feet from the ground depending on the height desired for the plant. Tree roses of practically all of the hybrid teas can be bought. The cost of propagation makes them more expensive than the same variety grown as a bush rose.

Miniatures

This class of roses is characterized by small flowers and small plants. The plants range in height from six to twelve inches and the blooms are less than an inch in size. As a group they are not too popular in Louisiana. Pixie, Midget and Tom Thumb are varieties of this class.

Climbing Hybrid Teas

Bud mutations frequently occur on bush hybrid teas. One bud may make exceptional growth and that particular cane become much taller than the remaining canes. If this climbing type of growth is due to a bud mutation, this variation from the normal can be propagated asexually and the climbing characteristic perpetuated.

Generally speaking, climbing hybrid teas do not have as many blooming periods as the bush forms, but individual plants may produce many more blooms at one time. The additional foliage present on climbers and its distance from the ground make disease control more difficult than on bush types. Climbing roses could be of more importance in Louisiana than the number now planted indicates.

Tea

The tea group is characterized by small flowers, small leaves and growth that is usually not vigorous. They are normally recurrent bloomers until low temperatures induce dormancy. This group is of very little importance at the present time. Lady Hillingdon is one of the few varieties of this type still grown to some extent in Louisiana.

VARIETIES

One of the most important considerations when planning to plant a rose garden is the selection of proper varieties. There are hundreds of rose varieties, and the grower usually has to limit selections to a relatively few of them. Success with roses will depend to a great extent on the selection of varieties adapted to the area where they are to be grown. Varieties selected only from pictures in a catalogue can easily lead to disappointment. Varieties satisfactory under some conditions will not do under others. People may also differ as to what satisfies them when it comes to rose production. Individual preference in regard to color and shape should be taken into consideration. What may be considered excellent by one may be thought to be inferior by another. In the variety test at L.S.U. there are about 70 selected varieties. Of course there are many good varieties that have not been tried, but promising varieties will be added each year. New rose varieties are being developed by rose breeders. Most of the new varieties are being patented, which means they should not be propagated without authorization.

When the ornamental program at the Louisiana Agricultural Experiment Station was started, it was known that many varieties could be grown in the northern part of the state, but there was considerable doubt about the probable success with roses, except for a few varieties, in the southern part of the state. Two or three years should be sufficient time to indicate whether varieties may be successfully grown in an area. The number of years that bushes may live and grow successfully will take more time to determine.

Most yard gardeners are not interested in planting a large number of varieties. It is believed that it is better to plant three to six plants each of a few varieties than to set out one plant each of more varieties. In that way bouquets of a variety can be cut at one time.

There are four varieties of roses that have been recommended for planting in south Louisiana for several years. These varieties are Red and Pink Radiance, Etoile de Holland and Editor McFarland. After growing some of the newer varieties some people do not believe that Radiance roses should be recommended. It is believed, however, that in south Louisiana the two Radiance roses should still head the list of varieties to plant, for in this area they

Experimental Roses at L.S.U.

are the most vigorous growers and most dependable bloomers. They cannot compete with good specimens of many other varieties, out when other varieties are not available, the Radiance roses are very satisfactory. The shell pink Radiance, Mrs. Charles Bell, is fairly good but not in the class with the two Radiance roses recommended. Varieties are sometimes sold as White Radiance but there is no white rose in the class of the Red or Pink Radiance. The Etoile de Holland is a popular, old, red variety. It is a semi-double rose. The stems are sometimes not strong enough to hold the blooms up as they should. Editor McFarland is a very good pink rose. Its blooms are borne in clusters and require a lot of disbudding to produce specimen flowers. There is another variety, Charles K. Douglas, that is quite similar to Etoile de Holland but may grow a little more vigorously. A poor, full-double rose is sometimes sold as Charles K. Douglas.

The following patented roses are recommended as worthy of trial:

Peace—It is the outstanding variety at the present time and belongs in a class by itself. The color is somewhat variable but may be called a cream with more or less pink tinting. Cooler temperatures seem to make for more intense color. When fully opened, it is a very large rose but in spite of its size is very beautiful. It does not have as many blooms per bush as some varieties, but it should not be called a shy bloomer. It makes a vigorous growth, and the stems are relatively large in diameter.

Charlotte Armstrong—Rose color. This variety makes very long buds that are especially beautiful. It is a semi-double type. The bush makes a vigorous but not compact growth. This variety has been found to be generally satisfactory.

Countess Vandal—Salmon pink. A general favorite. It is especially beautiful in the bud stage. The plant does not make a very vigorous growth in south Louisiana, but it produces many beautiful blooms with few side buds.

Crimson Glory—Red. Still the most popular red rose. Produces large flowers in profusion but usually on fairly short stems. The plants tend to be low and spreading.

Nocturne—One of the most beautiful red roses. Long, pointed buds are produced. Plants make a vigorous, upright growth. The color of this rose tends to fade to some extent during very hot weather.

Mirandy—Dark red. A very popular variety. Plants make a vigorous growth. The color does not fade badly in hot weather. Buds are not pointed but tend to be stubbed off to some extent.

Eclipse—Yellow. The most popular yellow at the present time. It has bloomed profusely for two years in the variety test here. Best blooms were produced in spring and fall, but many good blooms were produced during the summer. The blooms tend to fade in hot weather. Blooms are only medium in size but are especially beautiful in the bud stage. Plants make only a fairly vigorous growth.

Lowell Thomas—Yellow. A relatively new variety that is gaining in popularity. It is a darker yellow than Eclipse but does not bloom as profusely.

Tallyho—Pink. A new pink that seems very promising. Plants make a good growth.

Texas Centennial—Flame and carmine. This is a sport of the President Hoover variety and makes a similar type of growth. It grows vigorously but rather straggly. Blooms are produced on long stems.

Picture—Pink. Produces medium small flowers in profusion. Plants make very good growth. It is a very satisfactory variety.

The Chief—Bicolor. This variety produces very large striking blooms on long stems. The bush itself tends to be low and spreading.

The following varieties have been grown for only one year but seem promising:

Debonair—cream yellow
Mme. Chiang Kai-shek—light cream
Bravo—red
Brandywine—cream
Christopher Stone—red
Girona—bicolor
Taffeta—bicolor
Sutter's Gold—bicolor

No white variety will be suggested for planting but Caledonia or K. A. Victoria may be as good as any. Snowbird has done very well for one year. It produces a medium sized white bloom. Frau Karl Druschki, often called White American Beauty, is a hybrid perpetual that can be recommended in its class. The plants make a much more vigorous growth than hybrid tea varieties. Blooms are produced profusely in the spring only, but some blooms may be obtained in the fall.

The following floribunda varieties are considered worthy of trial:

Pinocchio
Goldilocks
Fashion
Floradora

GRADE OF PLANTS TO BUY

Rose bushes are usually sold in three grades—No. 1, No. 1½ and No. 2. The No. 1 grade is the largest size and is the one recommended for planting. The size of No. 1 bushes will vary to some extent with the vigor of the variety. The more vigorous ones should have at least three canes. The best two-year-old, field-grown plants should be obtained for planting. They should be free of crown gall which is often found on rose bushes, though such plants should not be passed for sale by inspectors. Quality of rose bushes should not be sacrificed for bargain prices. If it is possible, plants that have gone into a normal dormancy should be obtained. Orders for plants should be placed early in the season to help insure obtaining the varieties desired. The time delivery is wanted should be specified when the order is placed. When the plants are received, they should be unpacked immediately and either planted or heeled in until they can be set out.

LOCATION

Good drainage is imperative if roses are to be grown successfully. This does not merely mean surface run off of water, but that water will percolate through the soil so that it will not stay waterlogged. If the soil is poorly drained because of an impervious layer near the surface, it is not suitable for planting roses. Under such conditions merely digging a pit and putting gravel in the bottom will do no good unless the depth is sufficient to go through the portion of soil preventing good drainage and allow the water to go through it. When drainage is not too good, raising the level of the rose bed should be beneficial. Even where drainage is thought to be good, raising the level of the rose bed may often be beneficial.

A location exposed to full sun is best for the rose garden. If such a site is not available, place the rose garden where it will get as much sunshine as possible. During the hottest part of the summer a little shade might be beneficial so far as color of blooms is concerned, but in the spring and fall it will not. Too much sun causes the color to fade.

Roses are grown almost exclusively for cut flowers, and the rose garden is usually not too pretty from the landscape standpoint. This means that, where choice can be exercised, the rose garden should not be located in a prominent place, such as the front yard.

SOIL

Roses are grown successfully on a wide range of soil types. In the average yard the grower does not have much choice. If a choice can be made, a loam soil with a porous clay subsoil is probably ideal. A mildly acid soil is best for roses, with a pH range of 6.0 to 6.5 probably being best.

SPACING

Because of lack of space or the desire to plant too many bushes, plants are often set out much too close together. If good growth is expected, plants must have ample space in which to grow. Three feet between plants in the row is a good spacing to use, and the distance between rows should be four to five feet. It is believed that one of the reasons why roses have grown so well in the experimental plots is that they have not been crowded. It is best for rose plantings to be in double rows rather than in three or more, so that they are more accessible for cutting blooms, dusting or spraying, pruning, etc.

PLANTING

The best time to set out roses may vary from year to year though it should be done in the dormant season. General recommendations must of necessity be a sort of compromise. In the South root growth often takes place though the above ground parts may be dormant. Plants should be set out in time for the root system to become somewhat established before active growth starts in the spring. If set out early and there is a period of mild weather, growth may start, and then, if a severe cold comes, plants may be damaged or killed. This happened in February, 1951. If plants are set late in the dormant season, poor growth usually occurs at least for a time.

January is probably the best time to plant roses in south Louisiana and February in north Louisiana. Most rose plants are sold bare rooted and should be dormant when they are set out. The rose bush apparently does not have a true rest period, and after the bushes are set out, they will grow when conditions are favorable for growth. If plants are set out in Louisiana in October or November, they are sure to start growth before low temperatures retard such growth. Such young growth may then be damaged by cold, or inferior blooms produced out of season may use reserve food in the plant to such an extent that growth will not be normal when spring comes. This happened to plants set out in January of 1950 at Baton Rouge because of a more open winter than is usual for this area.

Plants should be set out when the soil will work well. Do not plant when the soil is wet and soggy because under such conditions it is impossible to do a good job of planting. Preparation for planting roses should be begun well ahead of time. Even a year ahead is not too long. The bed should be raised if necessary and a considerable amount of organic matter worked into the soil. This may be a green-manure crop, leaves or manure of some kind. In any case the organic matter should be well decomposed before time to plant the bushes. Holes should be dug large enough to allow the roots to be spread in a normal position. A mound built in the hole is often better than trying to push soil under the roots. The plant should be set at a depth that allows the crown of the plant to be at or just beneath the surface after the soil has settled. If the plant is set too high, it will likely be damaged by wind or blown over. After the roots have been properly spread in the hole, surface soil alone or with some leaf mold should be added first as it will be in contact with the roots. As more soil is added, it should be firmed well around the roots. When the hole is nearly filled, the plant should be watered well. After the water settles, finish filling the hole with soil that is not muddy. It may be mounded slightly around the plant temporarily, but no further packing is necessary.

Experienced growers might use a little commercial fertilizer at planting time, but it would probably be better to wait and fertilize properly later. Many plants are damaged or killed by the use of too much fertilizer at planting time.

No pruning should be necessary at time of planting, but it may be done if essential.

FERTILIZER

There are a number of elements that are essential for plant growth. Most of these elements are obtained from the soil, some in very small quantities. If all of the essential elements that come from the soil are present, are in a form available to the plant and in sufficient quantity to meet the needs of the plant, no fertilizer need be added. Usually soils in the South are deficient in one or more of these elements. It is to supply these deficiencies that fertilizers are added. Information concerning the fertilizer needs of roses is not too conclusive. Work at Cornell University indicates that the nitrate level in the soil solution should be from 25 to 100 p.p.m. This means that it is possible to have too much as well as too little available nitrogen present. A fertilizer experiment was started with roses at the Louisiana Agricultural Experiment Station in February, 1949. Plots range from no fertilizer to those receiving heavy application of complete fertilizer and chicken manure and cow manure with and without the addition of complete fertilizer. After two years of growth there was little difference in growth of plants due to fertilizer treatment. Plants on all plots made excellent growth. The heaviest applications of cemmercial fertilizer used have done no apparent damage. Late in the season of the second year the plants on plots that had received manure were a little more vigorous than those on plots that received no manure. There is every reason to believe that response to the application of commercial fertilizer will be obtained as the years pass. The plots that received no fertilizer were beginning to show its lack in the spring of 1951.

The best time to apply fertilizer is in late winter. This would be about the middle of February in south Louisiana. The fertilizer should be applied broadcast in an area extending about 18 inches in every direction from the crown of the plant. The fertilizer should be well distributed over the area and not too much left in one place. It is best to work the fertilizer into the soil around the plants. Only a rather general suggestion can be given as to the amount to apply, and that is from ⅛ to ¼ pound of 8-8-8 fertilizer per plant or its equivalent. The rate of application of a complete fertilizer is usually based on the nitrogen content. That would mean that half as much fertilizer that contains 8 per cent N should be used as one containing only 4 per cent N. In good soil one application of complete ferilizer should be sufficient. An application of nitrate of soda or its equivalent at the rate of one to two ounces per plant in August may be beneficial for the fall blooms. In very sandy soils additional nitrogen may be beneficial, but it should not be applied late enough to stimulate growth that might be subject to winter injury. Fertilizer should be used with caution for it may be that more rose bushes have been damaged by the use of excessive amounts than from its lack. It is believed, however, that in the South the use of some fertilizer will, under most conditions, be beneficial.

Organic matter in the form of manure will be found to be generally beneficial to rose plants. Well decomposed barnyard manure should be broadcast uniformly over the rose bed at the rate of 10 to 20 tons per acre. It should be remembered that manure often contains weed and grass seeds that are not desirable.

CULTIVATION

The main reasons for cultivation are to control weeds and grass and to prevent the soil from becoming too compact. Aside from being unsightly, weeds and grass compete with the rose plants for water and essential elements that are obtained from the soil. If the soil becomes too compact the plant may suffer because of insufficient oxygen to supply the needs of the roots. The main cultivation should be given right after the winter pruning and just prior to the application of fertilizer. Only light cultivation should be given the rest of the year, so as not to damage the roots of the rose plants unnecessarily.

ROSE PROPAGATION

Cuttings

Most of the common varieties of roses can be propagated by cuttings. A rose propagated from a cutting is own-rooted. It has developed roots from its own tissues.

Information on the longevity of the newer and many of the older varieties of hybrid teas on their "own roots" is not available. Some of the older hybrid tea varieties do well on their own roots. In Baton Rouge there are a few Pink and Red Radiance plants eighteen years of age that were propagated from cuttings that flower regularly. It is quite possible that many varieties will perform satisfactorily on their own roots. It takes from two to four years to produce a desirable plant from a cutting and apparently many varieties do not do well when own-rooted. Experiments are being set up in the ornamental research program at the Louisiana Agricultural Experiment Station to test own-rooted roses versus budded roses and to get information on the best stocks to use for budding roses to be grown under Louisiana conditions.

Cuttings can be made from roses during the growing season or during the dormant season. If cuttings are taken during the growing season, they are semi-hardwood cuttings and can be made from a stem just before blooming, at the time of bloom, or just after blooming. Semi-hardwood cuttings root best if given special attention. Fair results can be expected if cuttings are treated as follows: Use a cutting box with six-inch sides that has holes in the bottom for drainage. Cover the holes with an inch of gravel or broken pottery. Use a mixture of ½ sand plus ½ vermiculite by volume or sand alone as a rooting medium. A mixture of ½ peat and ½ sand is also satisfactory. Cover the cutting box with unbleached sheeting so that the sheeting will be around 24 to 30 inches above the sides of the cutting box. Place the cutting box in a shaded place and water down well. The cuttings should be 5 to 7 inches in length and the basal cut should be made just below a bud. The upper leaves should be left on the cutting. Dip the basal end of the cutting in one of the commercial root-inducing materials. Those that have the weaker concentrations should be used and not the ones sold to be used on plants that are hard to root. Then place the cutting in the cutting bed, leaving 2 to 3 inches of the cutting exposed above the rooting medium. Keep the rooting medium moist, never allowing it to dry out.

Hardwood cuttings are generally taken during December, January and February after the plants are defoliated. Cuttings 8 to 10 inches in length about the size or slightly larger than a lead pencil are used. These should be placed about four inches apart in well prepared and well drained rows. Root stimulants are probably of no value on hardwood cuttings. Hardwood cuttings should be placed deep in the soil with only two buds exposed. This is an excellent method for obtaining plants to be used as an understock for budding. During most seasons a covering or other protection is not necessary for hardwood cuttings in Louisiana.

Budding

Practically all roses sold for outdoor growing have been budded. The T or shield method of budding is used. It is the same method that is used in propagating citrus and peaches. Multiflora, Ragged Robin, Odorata, Manetti, Dr. Huey and others are used as understock for budding. In budding, the understock furnishes the root system, and the bud or scion placed in it forms the top of the plant. Buds on the lower part of the cuttings to be used as stocks should be removed to prevent growth from the stock after propagation.

When the understock attains the size of one-fourth to six-sixteenths of an inch in diameter it is large enough to bud. Budding can be done at any time the bark is slipping. The technique involved in budding roses is simple. A T cut about an inch in length is made through the bark as low as possible on the understock. A bud that has been cut in a shield shape is then inserted into the T cut. The bud should come from wood that is not succulent or that is not too hard. The cut on individual buds should start one-half inch below the bud and stop one-half inch above it. A portion of the leaf petiole can be left on the bud to aid in placing the bud in the T cut slit. The bud is inserted into the slit at the top of the T after the sides of the lower portion of the T have been peeled open. After proper placement of the bud the complete area below and above the bud should be wrapped with rubber budding strips, raffia or cotton twine. The bud itself should not be covered with the wrapping material. If the bud is green two weeks after budding, the chances are it has "taken." If twine or raffia was used in wrapping, it should be removed at this time. If rubber strips were used, they will rot and not girdle the bud.

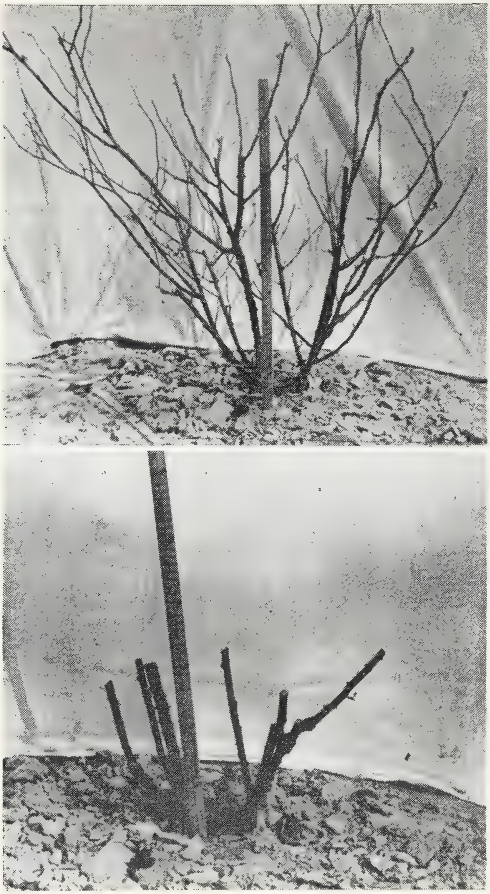
If the budding operation is performed in the spring, the understock can be cut off just above the bud as soon as it has taken. If the budding is done in late summer, it is better to wait until the following spring to remove the part of the understock above the bud. Late summer or fall removal might force the bud into growth that would be injured by winter temperature.

PRUNING

Bush Roses

The recommended time for pruning roses in Louisiana is in February. In general the later in the season pruning is done, the later will be the first crop of blooms. As soon after pruning as weather conditions permit, new growth will start on the plants, and it may be damaged by severe cold following growth. That is the risk of pruning in December or January. The grower will have to use his own judgment as to how much chance he wants to take to get very early blooms. If pruning is delayed too long, growth may be reduced considerably, at least early in the season. Good pruning shears that will make clean cuts should be used. The shape of the bush may be controlled to some extent by pruning to inside or outside buds, but varieties tend to have a characteristic shape which is not likely to be altered too much. Heavy gloves should be worn when pruning roses, and even then some thorns will be felt.

There is some variation of opinion as to the extent of the pruning that should be done. It should be remembered that in general pruning has a dwarfing effect on the plant. Its apparent stimulatory effect is due to the reduction of growing points, thus giving more vigorous shoots but not as many. Pruning of rose bushes is done to regulate the size of the plants and to increase the length of the stems of blooms. It also removes dead and dying canes. Four to six healthy canes should be left per plant. Plants of vigorous varieties such as Radiance may be cut back at the winter pruning time to 12 to 15 inches from the ground. Most varieties should be cut back to from 18 to 20 inches from the ground if that much can be left. Weak growing plants should be pruned lightly.



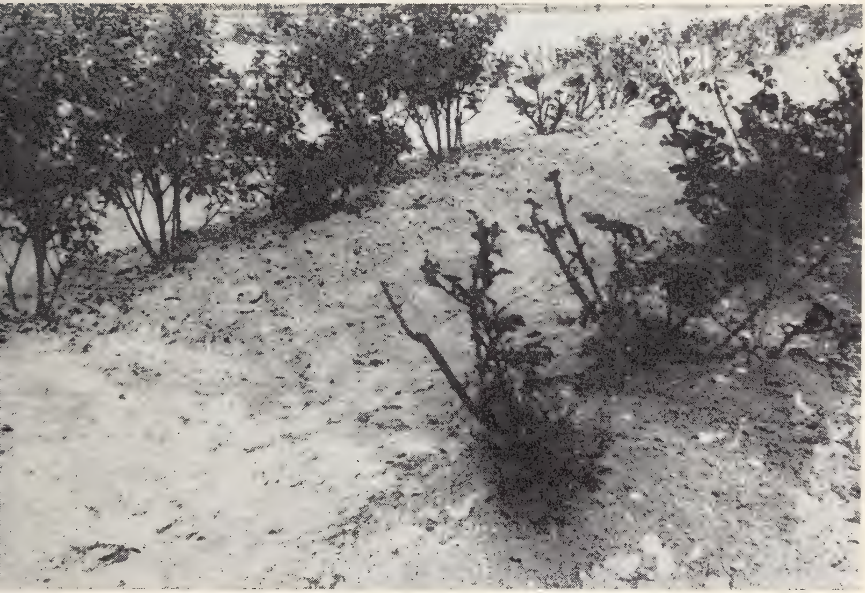
Top picture: Unpruned Radiance rose; lower picture: Same bush pruned.

In the South where vigorous growth has been made during the summer and bushes are tall and ragged looking, another general pruning should be made in August. This is done to get the bushes in condition for the fall bloom. It should not be as severe as the winter pruning. Canes should be cut back to about 24 to 30 inches from the ground and some thinning out done.

Climbing Roses

Pruning of climbing roses is a little different from pruning bush roses. Early blooms are produced on canes of the previous year's growth so that, if it is reduced extensively, the number of blooms will be decreased considerably. Pruning after the first bloom period is generally recommended. The spring bloom of hybrid perpetual climbers is the main bloom though there may be a

Pruned plants in fertilizer plots.



Large plants at left unpruned, others pruned.

light bloom in the fall. Climbing roses should be pruned sufficiently to keep them within the limits of the trellis or other support used. Some so-called climbing roses are really pillar roses, but they should be pruned similarly to real climbers.

Floribunda roses should be pruned according to vigor of growth and their adaptation to the general landscape design.

DISBUDDING

If flowers of exhibition varieties are to be grown for show purposes, they must be disbudded. This means that only one bud, the terminal, should be allowed to bloom per stem. The side buds should be removed when they are very small and can be easily removed without leaving noticeable scars. In a large rose planting, proper disbudding will consume considerable time, but it greatly affects the quality of blooms produced. When quantity of blooms is more desired than quality, disbudding need not be practiced so carefully. Some varieties, such as Talisman, often have terminal buds that tend to be defective, in which case disbudding should not be done too thoroughly. There is a varietal difference in the way blooms are produced. Some tend to have few, if any, side buds, while others tend to bloom in clusters.

CUTTING BLOOMS

There is a common belief that rose blooms must be kept cut if the bush is to continue blooming profusely. This is not necessarily true. Blooms left on the bushes too long tend to be unsightly, and, if seed are allowed to set, their development will be a drain on the plant. Roses are grown primarily for cut flowers, and that means that they will be cut. Roses can be cut to such an extent that the bush will be injured. Very few, if any, should be cut from the first crop of blooms after the plants are set out. When plants make a new growth, it is at the expense of reserve food in the plant. Leaves from the new growth if not removed replace this food and add to it, thus helping to keep the plant in good condition and allowing it to grow. If too many blooms with their accompanying leaves are removed the plant will not grow as it should. Let the plant get well established before cutting the blooms too freely. Even established plants should not be cut severely enough, when removing blooms, to injure the plant materially. Cutting blooms, if properly done, is in reality a type of pruning and may prevent the bushes from growing out of bounds. The bushes will likely thrive better if some of the blooms are enjoyed on the bushes. It is believed that another reason the bushes in the test garden have grown so well is that blooms were not cut when the plants were small.

The best time of day to cut roses is now believed to be in the fternoon. This is because at that time there are more food reserves n the parts removed, and for that reason the flowers should keep etter. It should be remembered, however, that during hot weather lowers open rapidly and what were buds in the morning may be ull open blooms by late afternoon.

MULCHING

Proper mulching is beneficial to the rose garden. Materials uch as pine straw, oak leaves, sawdust, bagasse, etc. may be used. The mulch should be no more than from 2 to 3 inches deep. It will help conserve moisture and tend to discourage weed and grass growth. When mulch materials decompose, they add organic matter to the soil. In the process of decomposition nitrogen is necessary, and mulching usually makes the addition of extra nitrogen beneficial.

IRRIGATION

While good drainage is absolutely essential for the successful growth of roses, the plants should not suffer for lack of water. This means that at certain times during the year watering will be beneficial. As with other plants, when roses are watered, the job should be done thoroughly; then wait about a week before it is repeated. Raised beds recommended for roses make the task of watering properly more difficult. If the water can be applied without wetting the leaves, leaf diseases will not spread as badly.

DISEASES AND INSECTS

Healthy, vigorous rose plants are necessary for the production of high quality flowers. To grow that type of rose plant, diseases and insects must either be prevented from attacking them or controlled when they appear. Badly diseased plants or those heavily infested with insects cannot make sufficient growth to produce good blooms, nor are they likely to live long.

The two most serious rose diseases that occur in Louisiana are blackspot and mildew. Blackspot normally is the most injurious. Failure to control it is one of the main reasons for lack of success with roses.

Blackspot is caused by a fungus. It usually occurs first on the leaves nearest the ground but will spread over the plant. The first noticeable symptoms are small purplish or dark gray spots on the leaves. These spots may increase in size and darkness of color. After a few days the area of the leaves surrounding the spots becomes yellow. These spots contain thousands of spores that can be spread, especially under moist conditions, by wind, insects and other means. Severe infections, if not checked, may cause complete defoliation of certain rose varieties.

Mildew is normally most troublesome during the early spring months when the temperature is still relatively low, and generally disappears after hot weather begins. Buds, stems and leaves infected with the organism that causes mildew have a whitish coating that is easily seen. Leaves frequently become curled and twisted after infection. The rambler type roses are very susceptible to mildew injury.

Most of the commercial fungicide preparations sold for rose diseases will give effective control if applied properly. For best control it is essential that plants be sprayed or dusted with an effective fungicide before the disease organism attacks and that a protective covering be kept on the plants at all times. In general the spraying of plants will give better disease control than dusting, because the material used will stay on the plants longer and will not wash off as easily. Dusting is often more easily and quickly done than spraying, but it takes more material. The residue left on the foliage from spraying is objectionable. This is particularly true when fermate or one of the copper compounds is used. When a fungicidal spray is applied to plants in bloom, it should be kept off of the blooms as much as possible.

If the following directions are followed, very good control of blackspot and mildew should be obtained. After the rose plants are pruned in February, the pruned portions should be removed and burned. All leaves and other debris should be raked from the ground around the plants and burned. The pruned plants and the ground around them should then be sprayed with Bordeaux mixture or a similar copper compound. This should tend to prevent an early infection of disease organisms. When spring growth begins, the plants should be sprayed or dusted at intervals of one week with suitable fungicides. During periods of rainfall more frequent applications would likely be beneficial. It is important to have the spray or dust material on the plant before a rain and as soon after as possible. Tribasic copper sulphate used at the rate of three pounds to 50 gallons of water with a little soap powder or flakes used as a sticker has given good control of blackspot in the L.S.U. experimental plots. This is at the rate of one ounce to 1.04 gallons of water. Some foliage injury can be expected from the use of copper compounds during cold, wet periods. If Bordeaux mixture is used, the standard 4-4-50 mixture (4 pounds bluestone, 4 pounds of lime and 50 gallons of water) is satisfactory. Fermate used at the rate of ½ to ¾ pound to 50 gallons of water is effective against blackspot but not against mildew. Diathane Z-78 at the rate of ¾ to 1 pound per 50 gallons of water with a little soap sticker should be satisfactory. Wettable sulphur may be used as a spray. Sulphur used as a dust is effective against rose diseases if kept on the foliage. A mixture made of about 88 per cent sulphur and 12 per cent copper is a more effective dust. It is probably best to get such a mixture already made than for the individual to try to mix it. During very hot weather there is likely to be some damage to foliage caused by sulphur. The addition of sulphur to soil will lower the pH of the soil. If added in sufficient quantity, the soil will become too acid for rose plants to grow well. The accumulation of sulphur used as a dust may cause harmful soil acidty. This means that sulphur as a dust should be applied in a good duster and not used in excessive amounts. Late in the afternoon is probably the best time to apply dust.

Crown gall is a bacterial disease that attacks the roots and crown of the rose and many other plants. It causes the formation of gall-like structures. If a plant has galls on the roots or crown, t should be destroyed rather than planted.

Chewing insects can be controlled best with market preparaions of DDT, or by use of cryolite. It is impossible to prevent some damage to buds from some night flying insects. Thrips frequently prevent the opening of blooms on plants of certain rose varieties. This is especially true with buds that have a large number of petals. Unless controlled, thrips are nearly always present in ose flowers. The best control is to use DDT. Aphids or plant lice re very troublesome on the new growth of roses and can do coniderable damage. They may cover the tips of growing shoots and uds. They are sucking insects and must be controlled by the se of a contact insecticide. Nicotine sulphate (Blackleaf 40) at he rate of 1½ to 2 teaspoons per gallon of water to which a little oap is added should destroy aphids. The spray is most effective t high temperatures. Spray as often as aphids are found. Roenone, which is a constituent of derris and some other materials, is lso effective against aphids. Contact insecticides must come into irect contact with the insects that are to be killed.

IN CONCLUSION

The experimental rose plots at L.S.U. have definitely shown hat many varieties of roses can be successfully grown in south ouisiana. Some varieties have done better than others. Plants an not be judged by one period of bloom, but flower and growth ver the whole season should be considered. Many people are still likely to be disappointed with roses in their own yards because they may not be able to meet all the requirements necessary for excellent rose production or because some have been neglected. It isn't always easy to do everything that should be done or to do it at the right time. For emphasis the following points, important for best success with roses, are stated again though they have been discussed in this bulletin.

1. Be sure that the rose bed has good drainage.
2. Have exposure to full sun if possible.
3. Prepare the soil well in advance of planting.
4. Get the best plants obtainable.
5. Plant varieties that are adapted to the area.
6. Set the plants at proper time of year and when the so is not muddy.
7. Let the plants become well established before cutting blooms.
8. Disbud when side buds are small.
9. Do not apply too much fertilizer.
10. Decomposed organic matter is beneficial.
11. Prune at proper times.
12. Irrigate thoroughly when necessary.
13. Control black spot and other diseases.
14. Control aphids, thrips and other insects.

The planting of roses should not be discouraged even though all qualifications can not be met. A rose garden that is only fair is far better than none at all.

5 D

Roses For The Yard

By

R. H. HANCHEY and W. D. KIMBROUGH

LIBRARY
FEB
NEW [illegible] STATE
UNIVERSITY

The Peace Variety

Bulletin No. 451 (Revised) June, 1955

LOUISIANA STATE UNIVERSITY
and
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
J. N. EFFERSON, Director

Roses For The Yard

By

R. H. HANCHEY and W. D. KIMBROUGH

INTRODUCTION

There is no doubt that the rose is the most universally popular flower grown. There are many other beautiful flowers, such as the camellia, gladiolus, iris, daylily, narcissus and several other ornamental plants, that have many followers, but no other flower is a real rival of the rose. The fact that some kind of rose can be grown in most localities where any plant will thrive accounts for much of its widespread popularity. Its great range of types and colors, pleasing fragrance and unsurpassed beauty as a cut flower usually give it first consideration as a plant for home gardens. Here in the deep South it is possible to have roses in bloom in the open for a period of eight to nine months in a year. While the rose is generally grown as a cut flower, some types may be worked into a planned landscape. As the rose plant is a perennial, a rose bed properly cared for should be satisfactory for a number of years.

There is very little experimental information concerning the culture of roses in this area, but it is very much needed and desired. In general until the last few years, it has been believed that only a few varieties of roses could be successfully grown by the average person in south Louisiana. Many more people would grow roses if they could expect to grow satisfactorily some of the newer, more prized varieties. Experimental work was started with roses at the Louisiana Agricultural Experiment Station in January 1949. Several years have passed since then and a progress report on results obtained is given in this bulletin. Other information is based on observations and experimental work done here and elsewhere.

ROSE CLASSIFICATION

The average rose grower considers all roses as being either bush or climbing types. There are, however, several classes of roses, some being satisfactory and some unsatisfactory as a group but having individual varieties of special merit within the group. Bush roses are generally divided into the following classes: hybrid teas, hybrid perpetuals, grandifloras, teas, polyanthas, hybrid polyanthas (floribundas), tree or standard, and miniature.

Hybrid Teas

Varieties of this class are of relatively recent origin and are the result of crosses between tea roses and hybrid perpetuals. This group is of far more importance than the other groups, as it contains most of the varieties commonly grown now. Practically all greenhouse roses sold by florists are of the hybrid tea group. They are classified as continuous bloomers, which means they bloom in cycles until stopped by unfavorable environmental conditions such as cold weather. The growth habits of the different varieties in this group vary, but generally speaking they range in height from two to six feet, with most being intermediate. They vary in form from the sprawling type of growth made by varieties like Crimson Glory to the upright growth of varieties like Texas Centennial. The foliage varies in color from the light green of Talisman to the dark green of Peace. Flower form may vary from the delicate single blossom of Dainty Bess to the full double of Briarcliff. Many of the hybrid teas are fragrant; others are not. Hybrid teas as a group are recurrent bloomers and are fairly vigorous growers.

Hybrid Perpetuals

The word perpetual in this case is very misleading. The hybrid perpetuals as a group are not perpetual bloomers, as their main blooming period is in the spring. During the time when they were most popular they came nearer to being perpetual bloomers than other types grown at that time. As a group they are of little importance today. American Beauty and Ulrich Brunner are varieties of this group. The variety Frau Karl Druschki is a hybrid perpetual and probably the best white variety for growing in Louisiana. The group as a whole grows vigorously and makes a stiff, upright type of growth and has dull green leaves and very double and somewhat flat blooms. They may or may not be fragrant.

Polyanthas

Plants of this group seldom grow over two feet in height. The flowers are small in size and borne in clusters. Fragrance is lacking in many varieties. Cecile Brunner (Sweetheart rose) and George Elger are examples of this group. This group is gradually being replaced by the hybrid polyanthas or floribundas.

Hybrid Polyanthas (Floribundas)

This class probably ranks second to the hybrid teas in importance at the present time. As a group they are similar to the true polyantha, but individual plants attain greater size. The blooms are borne in clusters and are generally larger than those of the polyanthas. The number of buds per cluster may vary considerably with different varieties. This is an important group of roses but cannot compare with the hybrid teas as a source of cut flowers or for exhibition purposes.

Grandiflora

In 1954 a new class of roses was added to the list. It is called grandiflora. It includes new rose varieties that have the following characteristics:

1. Plants of relatively tall growth.
2. Plants free flowering, often with many flowers in clusters but with individual stems long enough for cutting.

3. Flower size not necessarily as large as hybrid teas but larger than the average floribunda.
4. Hybrid tea standard for bud and flower form.

This class seemed necessary because of the production of hybrid roses that could not be easily classified in existing groups. Examples of varieties in this class are Queen Elizabeth and Roundelay.

There may be some confusion as to classification for a time at least. It would seem that several older varieties that are intermediate between floribundas and hybrid teas should be in this class. They could easily be placed in this class if the relatively tall growth is not emphasized.

Tree or Standard

Very few tree roses are grown in Louisiana. Many people dislike the constant pruning that is necessary to keep the top of a tree rose in a pleasing shape and the staking of plants which is essential for their support. Where hard winds are likely to occur the stake must be a strong one. A tree or standard rose can be any variety of bush rose. Hybrid teas and floribundas are probably used most. A tree rose is produced by selecting a straight-stemmed cane and placing one or two buds of the desired variety in it two to six feet from the ground, depending on the height desired for the plant. Tree roses of many of the hybrid teas can be bought. The cost of propagation makes them more expensive than the same variety grown as a bush rose.

Miniatures

This class of roses is characterized by small flowers and small plants. The plants range in height from six to twelve inches and the blooms are less than an inch in size. As a group they are not too popular in Louisiana. Pixie, Midget and Tom Thumb are varieties of this class.

Climbing Hybrid Teas

Bud mutations frequently occur on bush hybrid teas. One bud may make exceptional growth and that particular cane become much taller than the remaining canes. If this climbing type of growth is due to a bud mutation, this variation from the normal can be propagated asexually and the climbing characteristic perpetuated.

Generally speaking, climbing hybrid teas do not have as many blooming periods as the bush forms, but individual plants may produce many more blooms at one time. The additional foliage present on climbers and its distance from the ground make disease control more difficult than on bush types. Climbing roses could be of more importance in Louisiana than the number now planted indicates.

Teas

The tea group is characterized by small flowers, small leaves and growth that is usually not vigorous. They are normally recurrent bloomers until low temperatures induce dormancy. This group is of

Experimental Roses at L.S.U.

very little importance at the present time. Lady Hillingdon is one of the few varieties of this type still grown to some extent in Louisiana.

VARIETIES

One of the most important considerations when planning to plant a rose garden is the selection of proper varieties. There are hundreds of rose varieties, and the grower usually has to limit selections to only a few of them. Success with roses will depend to a great extent on the selection of varieties adapted to the area where they are to be grown. Varieties selected only from pictures in a catalogue can easily lead to disappointment. Varieties satisfactory under some conditions will not do under others. People may also differ as to what satisfies them when it comes to rose production. Individual preference in regard to color and shape should be taken into consideration. What may be considered excellent by one may be thought to be inferior by another. In the variety test at L.S.U. there are about 100 selected varieties. Of course there are many good varieties that have not been tried, but promising varieties are added each year. New rose varieties are constantly being developed by rose breeders. Most of the new varieties are being patented, which means they should not be propagated without authorization.

When the ornamental program at the Louisiana Agricultural Experiment Station was started, it was known that many varieties could be grown in the northern part of the state, but there was considerable doubt about the probable success with roses, except for a few varieties, in the southern part of the state. Two or three years should be sufficient time to indicate whether varieties may be successfully grown in an area. The number of years that bushes may live and grow successfully will take more time to determine.

Most yard gardeners are not interested in planting a large number of varieties. It is believed that it is better to plant three to six plants each of a few varieties than to set out one plant each of more varieties. In that way bouquets of a variety can be cut at one time.

There are four varieties of roses that have been recommended for planting in south Louisiana for several years. These varieties are Red and Pink Radiance, Etoile de Holland and Editor McFarland. After growing some of the newer varieties some people do not believe that Radiance roses should be recommended. It is believed, however, that in south Louisiana the two Radiance roses should still head the list of varieties to plant, for in this area they are the most vigorous growers and most dependable bloomers. They cannot compare with good specimens of many other varieties, but when other varieties are not available, the Radiance roses are very satisfactory. The shell pink Radiance, Mrs. Charles Bell, is fairly good but not in the class with the two Radiance roses recommended. Varieties are sometimes sold as White Radiance but there is no white rose in the class of the Red or Pink Radiance. The Etoile de Holland is a popular, old, red variety. It is a semi-double rose. The stems are sometimes not strong enough to hold the blooms up as they should. Editor McFarland is a very good pink rose. Its blooms are borne in clusters and require a lot of disbudding to produce specimen flowers. Bushes of this variety have been rather severely damaged by die-back in the experimental plots and for that reason it is not highly recommended for planting. There is another variety, Charles K. Douglas, that is quite similar to Etoile de Holland but may grow a little more vigorously. A poor, full-double rose is sometimes sold as Charles K. Douglas.

The following patented roses are recommended as worthy of trial:

Peace—It is still the outstanding variety and belongs in a class by itself. The color is somewhat variable but may be called a cream with more or less pink tinting. Cooler temperatures seem to make the colors more intense. When fully open, it is a very large rose somewhat similar to the hybrid perpetual type, but in spite of its size is very beautiful. It does not have as many blooms per bush as some varieties, but it is really not a shy bloomer. It makes a vigorous growth, and the stems are very large in diameter. However, growers in Louisiana have not been uniformly successful in growing this variety.

There are now on the market a number of good red varieties, and for that reason there are more of this color to select from than other colors. Some of the better ones are as follows:

Crimson Glory—Still the most popular red garden rose. Produces large buds and flowers in profusion but usually on fairly short stems. Blooms are produced a little later in the season than those of the other red varieties mentioned. The plants tend to be low and spreading. This variety should be found to be generally satisfactory.

Nocturne—One of the most beautiful red roses. Long, pointed buds are produced. The plant makes a vigorous upright growth. The color of this rose tends to fade to some extent during very hot weather.

Mirandy—A very dark red rose. It is a very popular variety. Plants grow vigorously and produce an abundance of flowers. The color does not fade badly in hot weather. The buds are not pointed and are not too pretty until they are partly open.

Big Daddy—The plants make very good growth and large, well-shaped buds are produced. Best blooms have been obtained in the fall.

New Yorker—A very good red rose that should be satisfactory.

Chrysler Imperial and **San Fernando** are also good varieties.

There are some varieties that are sold as reds that have been rose colored in the test plots here. The following varieties of this type are recommended:

Charlotte Armstrong—This variety produces very long buds that are especially beautiful. The bush makes a vigorous but not compact growth. This variety is highly recommended as one of the best to plant.

Rubaiyat—Plants make a vigorous growth and produce a profusion of blooms. This is an excellent variety.

Gay Lady—This rose is more nearly red in the fall. The plants make a very vigorous growth. The foliage is dark green and characteristic of the variety. This variety is highly recommended.

There are many varieties of pink roses but not too many can be recommended. Some of the varieties listed are two-toned and may be considered bicolors by many people.

Countess Vandal—This has been a general favorite of those visiting the test garden here. It produces large, long, pointed buds that always attract attention. The plant does not make a very vigorous growth in south Louisiana, but it produces many beautiful blooms with a few side buds.

Mission Bells—Plants make good growth and bloom very well. It is one of the better pink varieties.

Capistrano—A good pink. Plants make good growth and bloom profusely.

Picture—The plants are only medium in size. Blooms are not large but they are very pretty. A great abundance of flowers is produced. Except for size this is a very satisfactory variety.

The Doctor—When well grown this is an outstanding pink variety. It can not be generally recommended because it often does not do well. A slight amount of shade will probably be beneficial to plants of this variety during hot weather.

Excellent yellow roses have not been found to be too plentiful so far, but there are a few that can be recommended.

Eclipse—This is still the most popular yellow variety. It has bloomed profusely for six years in the variety test here. The best blooms were produced in the spring and fall, but many good blooms have been produced in the summer. The blooms tend to fade in hot weather, and it is not an intense yellow at best. Blooms are not large but many are produced. It is especially beautiful in the bud stage. The plants make only a fairly vigorous growth.

Buccaneer—This is a fairly new variety but it appears to be an excellent one. The plants are exceptionally vigorous in growth and the blooms are a bright yellow. The buds are medium in size and not very pointed.

Golden Masterpiece—This is a new variety that seems very promising. The flowers contain more petals than most yellow roses. The plants make good growth.

There are a number of bicolor roses that are good, though the group in general requires a little more attention than some of the other kinds. Where proper care can be given, the beauty of the blooms obtained is often worth the added trouble.

Sutters Gold—This is considered to be one of the best varieties of this group. The yellow, orange-tinted flowers vary considerably in shade of coloring.

Girona—In the test plots this has been one of the best bicolors. The plant makes a vigorous growth and produces many beautiful blooms.

Helen Traubel—The color is pink and apricot. This is one of the newer varieties that seems very promising. The plants grow well and produce beautiful buds. The buds, however, open rather rapidly.

The Chief—This variety produces very large striking blooms on long stems. The bush itself tends to be low and spreading.

The following varieties have done very well and are worthy of trial:

Lowell Thomas—yellow
McGredy's Yellow—yellow
Taffeta—bicolor
Grande Duchesse Charlotte—medium red
Show Girl—pink
Better Times—red

The following newer varieties seem very promising:

Mojave - LaJolla - Tiffany

No white variety that can be recommended has been tried as yet. Caledonia and K. A. Victoria, a cream white, have been as good as any. If size is not important, Snowbird is all right. White varieties seem to be especially subject to thrip injury. Frau Karl Druschki, often called White American Beauty, is a hybrid perpetual that can be recommended in its class. The plants of this variety make a much more vigorous growth than hybrid tea bushes; this should be considered when the plants are set out. Blooms are produced profusely in the spring only, but some blooms should be obtained in the fall.

Only a limited number of floribunda varieties have been grown in the test plots, but the following can be recommended.

Embers Fashion Frolic Goldilocks Jiminy Cricket
Pinocchio Siren Summer Snow Vogue Lilibet

GRADE OF PLANTS TO BUY

Rose bushes are usually sold in three grades—No. 1, No. $1\frac{1}{2}$ and No. 2. The No. 1 grade is the largest size and is the one recommended for planting. The size of No. 1 bushes will vary to some extent with the vigor of the variety. The more vigorous ones should have at least three canes. The best two-year-old, field-grown plants should be obtained for planting. They should be free of crown gall which is often found on rose bushes, though such plants should not be passed for sale by inspectors. Quality of rose bushes should not be sacrificed for bargain prices. If it is possible, plants that have gone into a normal dormancy should be obtained. Orders for plants should be placed early in the season to help insure obtaining the varieties desired. The time delivery is wanted should be specified when the order is placed. When the plants are received, they should be unpacked immediately and either planted or heeled in until they can be set out.

A number of rose plants are now grown and offered for sale in containers. In general these plants are smaller than field-grown plants. They may be transplanted at any time, provided that the soil remains intact when the container is removed and the plant set out. The container plants have the advantage of no root pruning at planting time, but the roots are restricted to the container area.

No particular source of plants can be recommended. Plants in the test plots have come from several sources in various parts of the United

States. Good, healthy plants of suitable varieties from all sources have done well. The important thing is to get good plants of varieties that are adapted to the area where they are to be grown. Cheap plants are often not a bargain, but a high price does not insure getting a good plant.

LOCATION

Good drainage is imperative if roses are to be grown successfully. This does not merely mean surface run off of water, but that water will percolate through the soil so that it will not stay waterlogged. If the soil is poorly drained because of an impervious layer near the surface, it is not suitable for planting roses. Under such conditions merely digging a pit and putting gravel in the bottom will do no good unless the depth is sufficient to go through the portion of soil preventing good drainage and allow the water to go through it. When drainage is not too good, raising the level of the rose bed should be beneficial. Even where drainage is thought to be good, raising the level of the rose bed may often be beneficial.

A location exposed to full sun is best for the rose garden. If such a site is not available, place the rose garden where it will get as much sunshine as possible. During the hottest part of the summer a little shade might be beneficial so far as color of blooms is concerned, but in the spring and fall it will not. To much sun causes the color to fade.

Hybrid tea roses are grown almost exclusively for cut flowers, and the rose garden is usually not too pretty from the landscape standpoint. This means that, where choice can be exercised, the rose garden should not be located in a prominent place, such as the front yard.

Many climbers, floribundas, and rose species may, however, be used as landscape material, as their type of growth and blooming habits may be well adapted for this purpose.

SOIL

Roses are grown successfully on a wide range of soil types. In the average yard the grower does not have much choice. If a choice can be made, a loam soil with a porous clay subsoil is probably ideal. A mildly acid soil is best for roses, with a pH range of 6.0 to 6.5 probably being best.

SPACING

Because of lack of space or the desire to plant too many bushes, plants are often set out much too close together. If good growth is expected, plants must have ample space in which to grow. Three feet between plants in the row is a good spacing to use, and the distance between rows should be 4 to 5 feet. It is believed that one of the reasons why roses have grown so well in the experimental plots is that they have not been too crowded. It is best for rose plantings to be in double rows rather than in three or more, so that they are more accessible for cutting blooms, dusting or spraying, pruning, etc. Less vigorous varieties, especially floribundas, may be spaced more closely than the more vigorous ones. Even these should not be spaced closer than 2 to 2½ feet in the row.

PLANTING

The best time to set out roses may vary from year to year, though it should be done in the dormant season. General recommendations must of necessity be a sort of compromise. In the South root growth often takes place though the above ground parts may be dormant. Plants should be set out in time for the root system to become somewhat established before active growth starts in the spring. If set out early and there is a period of mild weather, growth may start in the above ground parts and then, if a severe cold comes, plants may be damaged or killed. This happened in February 1951. If plants are set late in the dormant season, poor growth usually occurs at least for a time.

January is probably the best time to plant roses in south Louisiana and February in north Louisiana. If dormant plants can be obtained in December they might be all right for setting then in north Louisiana, provided they are not damaged by cold later on. Most rose plants are sold bare rooted and should be dormant when they are set out. The rose bush apparently does not have a true rest period, and after the bushes are set out, they will grow when conditions are favorable for growth. If plants are set out in Louisiana in October or November, they are sure to start growth before low temperatures retard such growth. Such young growth may then be damaged by cold, or inferior blooms produced out of season may use reserve food in the plant to such an extent that growth will not be normal when spring comes. This happened to plants set out in January of 1950 at Baton Rouge because of a more open winter than is usual for this area.

Plants should be set out when the soil can be worked well. Do not plant when the soil is wet and soggy because under such conditions it is impossible to do a good job of planting. Preparation of beds should be begun well ahead of time of planting. Even a year ahead is not too long. The bed should be raised if necessary and a considerable amount of organic matter worked into the soil. This may be a green-manure crop, leaves or manure of some kind. In any case the organic matter should be well decomposed before time to plant the bushes. Holes should be dug large enough to allow the roots to be spread in a normal position. A mound or cone of soil built in the hole is often better than trying to push soil under the roots. The plant should be set at a depth that allows the crown of the plant to be at or just beneath the surface after the soil has settled. If the plant is set too high, it will likely be damaged by wind or blown over. After the roots have been properly spread in the hole, surface soil alone or with some leaf mold should be added first as it will be in contact with the roots. As more soil is added, it should be packed well around the roots. When the hole is nearly filled, the plant should be watered well. After the water settles, finish filling the hole with soil that is not muddy. It may be mounded slightly around the plant temporarily, but no further packing is necessary.

Experienced growers might use a small amount of commercial fertilizer at planting time, but it would probably be better to wait and fertilize properly later. Many plants are damaged or killed by the use of too much fertilizer at planting time.

No pruning should be necessary at time of planting, but it may be done if essential.

FERTILIZER

There are a number of elements that are essential for plant growth. Most of these elements are obtained from the soil, some in very small quantities. If all of the essential elements that come from the soil are present in a form available to the plant and in sufficient quantity to meet the needs of the plant, no fertilizer need be added. Usually soils in the South are deficient in one or more of these elements. It is to supply these deficiencies that fertilizers are added. Information concerning the fertilizer needs of roses is not too conclusive. Work at Cornell University indicates that the nitrate level in the soil solution should be from 25 to 100 parts per million. This means that it is possible to have too much as well as too little available nitrogen present. A fertilizer experiment was started with roses at the Louisiana Agricultural Experiment Station in February 1949. There are 12 plants in each plot, two each of Red Radiance, Editor McFarland, Etoile de Holland, Countess Vandal, Crimson Glory and Eclipse. The plants were spaced 3 feet in the row and 6 feet between rows. Each treatment was replicated three times. The soil type is Lintonia silt loam.

The following treatments were used:

Check—no fertilizer

Chicken manure at the rate of 10 tons per acre.

Chicken manure at the rate of 10 tons per acre + ⅛ lb. 8-8-8 per plant.

Chicken manure at the rate of 10 tons per acre + ⅛ lb. 8-8-8 per plant + ⅛ lb. nitrate of soda per plant in August.

Barnyard cow manure at the rate of 20 tons per acre.

Barnyard cow manure at the rate of 20 tons per acre + ⅛ lb. 8-8-8 per plant.

Barnyard cow manure at the rate of 20 tons per acre + ⅛ lb. 8-8-8 per plant + ⅛ lb. nitrate of soda per plant in August.

Cottonseed meal at the rate of 2000 lbs. per acre.

Cottonseed meal at the rate of 2000 lbs. per acre + ⅛ lb. nitrate of soda per plant in August.

8-8-8 at the rate of ⅛ lb. per plant.

8-8-8 at the rate of ¼ lb. per plant.

8-8-8 at the rate of ¼ lb. per plant + ⅛ lb. nitrate of soda per plant in August.

8-8-8 at the rate of ¼ lb. per plant + ⅛ lb. nitrate of soda per plant in August + esminel at rate of ⅓ oz. per plant.

In 1951 the rates of 8-8-8 per plant were increased from $\frac{1}{8}$ and $\frac{1}{4}$ pound per plant to $\frac{1}{4}$ and $\frac{1}{2}$ pound per plant.

For three years there was very little difference in growth of plants on any of the plots regardless of fertilizer treatment. All made good growth and bloomed well. Plants on plots that received no fertilizer were only slightly behind and those on plots that received manure were slightly ahead of the plants on the other plots. The addition of fertilizer made no noticeable difference where manure had been applied. The difference in the rate of application of 8-8-8 had made no difference. There was no apparent damage to plants from any of the fertilizer treatments.

After six years plants of the no-fertilizer plots are very poor compared to those in other plots and if they live will not be very productive. Plants on plots that received manure have a definite superiority. The addition of commercial fertilizer to plots that received manure has shown no benefit to date. Plants on plots that received cottonseed meal are not superior to those that received 8-8-8. The addition of nitrogen to plots in mid-August gave some stimulation to plant growth after the fourth year.

The results obtained so far from the fertilizer test show that there is a definite response of the rose bush to the application of fertilizer, but that the rose does not need fertilizer in amounts often applied nor as frequently as it is often given. The application of manure has definitely been beneficial. Well-decomposed manure should be used. It should be remembered, however, that when manure is used weeds are usually more of a problem. The manure should be broadcast uniformly over the rose bed.

The best time to apply fertilizer is in late winter. This would be about the middle of February in south Louisiana. It should be applied broadcast in an area extending about 18 inches in every direction from the crown of the plant. The fertilizer should be evenly distributed over the area. It is best to work the fertilizer into the soil around the plants. Only a rather general suggestion can be given as to the amount to apply, and that is from $\frac{1}{8}$ to $\frac{1}{4}$ pound of 8-8-8 fertilizer per plant or its equivalent. Any good complete fertilizer may be used. The rate of application of a complete fertilizer is usually based on the nitrogen content. That would mean that half as much fertilizer that contains 8 per cent N should be used as one containing only 4 per cent N. In good soil one application of complete fertilizer per year should be sufficient. An application of nitrate of soda or its equivalent at the rate of 1 to 2 ounces per plant in August may be beneficial for the fall blooms. In very sandy soils additional nitrogen may be beneficial, but it should not be applied late enough to stimulate growth that might be subject to winter injury. Fertilizer should be used with caution, for it may be that more rose bushes have been damaged by the use of excessive amounts than from its lack. It is believed, however, that in the South the use of some fertilizer will, under most conditions, be beneficial.

CULTIVATION

The main reasons for cultivation are to control weeds and grass and to prevent the soil from becoming too compact. Aside from being unsightly, weeds and grass compete with the rose plants for water and essential elements that are obtained from the soil. If the soil becomes too compact the plant may suffer because of insufficient oxygen to supply the needs of the roots. The main cultivation should be given right after the winter pruning and just prior to the application of fertilizer. Only light cultivation should be given the rest of the year, so as not to damage the roots of the rose plants unnecessarily.

ROSE PROPAGATION

Cuttings

Most of the common varieties of roses can be propagated by cuttings. A rose propagated from a cutting is own-rooted. It has developed roots from its own tissues.

Information on the longevity of the newer and many of the older varieties of hybrid teas on their "own roots" is not available. Some of the older hybrid tea varieties do well on their own roots. In Baton Rouge there are a few Pink and Red Radiance plants growing and flowering well that were propagated by cuttings 21 years ago. It is quite possible that many varieties will perform satisfactorily on their own roots. It takes from two to four years to produce a desirable plant from a cutting but apparently some varieties do not do well when own-rooted. Experiments are in progress in the ornamental research program at the Louisiana Agricultural Experiment Station to test own-rooted roses versus budded roses and to get information on the best stocks to use for budding roses to be grown under Louisiana conditions.

The following rose varieties propagated from cuttings have grown satisfactorily for four years in experimental plots: Peace, Mirandy, Nocturne, Charlotte Armstrong, Red Radiance, Eclipse, Countess Vandal, Etoile de Holland and Crimson Glory.

Cuttings can be made from roses during the growing season or during the dormant season. If cuttings are taken during the growing season, they are semi-hardwood cuttings and can be made from a stem just before blooming, at the time of bloom, or just after blooming. Semi-hardwood cuttings root best if given special attention. Fair results can be expected if cuttings are treated as follows: Use a cutting box with 6-inch sides that has holes in the bottom for drainage. Cover the holes with an inch of gravel or broken pottery. Use a mixture of $\frac{1}{2}$ sand plus $\frac{1}{2}$ vermiculite by volume or sand alone as a rooting medium. A mixture of $\frac{1}{2}$ peat and $\frac{1}{2}$ sand is also satisfactory. Cover the cutting box with unbleached sheeting so that the sheeting will be around 24 to 30 inches above the sides of the cutting box. Place the cutting box in a shaded place and water down well. The cuttings should be 5 to 7 inches in length and the basal cut should be made just below a bud. The upper leaves should be left on the cutting. Dip the basal end of the cutting in one of the commercial root-inducing materials. Those that have the weaker concentrations should be used and not the ones sold to be used on plants that are hard to root. Then place the cutting in the cutting bed, leaving 2 to 3 inches of the cutting exposed above the rooting medium. Keep the rooting medium moist, never allowing it to dry out.

Hardwood cuttings are generally taken during December, January and February after the plants are defoliated. Cuttings 8 to 10 inches in length about the size of or slightly larger than a lead pencil are used. These should be placed about 4 inches apart in well-prepared and well-drained rows. Root stimulants are probably of no value on hardwood cuttings. Hardwood cuttings should be placed deep in the soil with only two buds exposed. This is an excellent method for obtaining plants to be used as an understock for budding. During most seasons a covering or other protection is not necessary for hardwood cuttings in Louisiana.

Budding

Practically all roses sold for outdoor growing have been budded. The T or shield method of budding is used. It is the same method that is used in propagating citrus and peaches. Multiflora, Ragged Robin, Odorata, Manetti, Dr. Huey, IXL and others are used as understock for budding. In budding, the understock furnishes the root system, and the bud or scion placed in it forms the top of the plant. Buds on the lower part of the cuttings to be used as stocks should be removed to prevent growth from the stock after propagation.

When the understock attains the size of one-fourth to six-sixteenths of an inch in diameter it is large enough to bud. Budding can be done at any time the bark is slipping. The technique involved in budding roses is simple. A T-cut about an inch in length is made through the bark as low as possible on the understock. A bud that has been cut in a shield shape is then inserted into the T-cut. The bud should come from wood that is not succulent or that is not too hard. The cut on individual buds should start one-half inch below the bud and stop one-half inch above it. A portion of the leaf petiole can be left on the bud to aid in placing the bud in the T-cut slit. The bud is inserted into the slit at the top of the T after the sides of the lower portion of the T have been peeled open. After proper placement of the bud the complete area below and above the bud should be wrapped with rubber budding strips, raffia or cotton twine. The bud itself should not be covered with the wrapping material. If the bud is green two weeks after budding, the chances are it has "taken." If twine or raffia was used in wrapping, it should be removed at this time. If rubber strips were used, they will rot and not girdle the bud.

If the budding operation is performed in the spring, the understock can be cut off just above the bud as soon as it has taken. If the budding is done in late summer, it is better to wait until the following spring to remove the part of the understock above the bud. Late summer or fall removal might force the bud into growth that would be injured by winter temperature.

Good plants have been produced here on all of the following understock: Multiflora, Ragged Robin, Dr. Huey, IXL, Manetti and Odorata. Only a limited number of plants have been grown so far but no one understock has shown superiority.

Grafting

Many of the greenhouse roses grown for cut flowers are grafted. The splice graft or whip graft is usually used on small stock. Most outdoor roses are budded rather than grafted.

Healthy, vigorous outdoor plants that produce undesirable flowers could be grafted successfully with desirable types. Either bark or cleft grafting could be used. Bark grafting should be done in early spring just after growth begins at a time when the bark will slip. A slanting cut of 1 to 1½ inches should be made on a dormant scion and the scion should be inserted into a T-slit made near the ground on the stock. After the scion begins growth the stock above the scion can be removed with a knife or pruning shears.

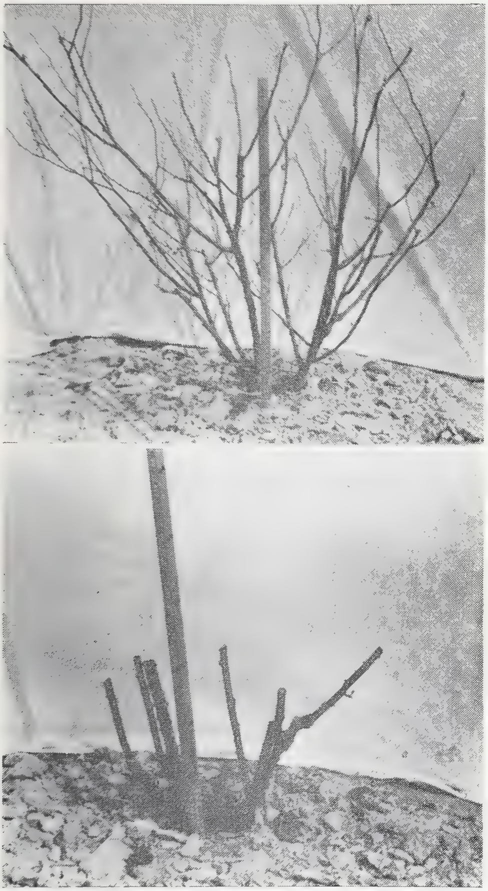
In cleft grafting the stock should be cut off 2 to 3 inches above the ground and a 2-inch slit made in the middle of the stock. Dormant scions 4 inches to 6 inches in length should be cut at the basal end in a wedge shape. The scions should then be inserted into the cleft.

Care should be taken in matching the cambium of the stock and scion. The cut portion of the graft should be treated with one of the wound healing materials such as Tree Kote, Tree Seal or a similar preparation. Cleft grafting would be more successful if done during the latter part of the dormant season, usually early February in Louisiana.

PRUNING

Bush Roses

The recommended time for pruning roses in Louisiana is in February. In general the later in the season pruning is done, the later will be the first crop of blooms. As soon after pruning as weather conditions permit, new growth will start on the plants, and it may be damaged by severe cold following growth. That is the risk taken when pruning is done in December or January. The grower will have to use his own judgment as to how much chance he wants to take to get very early blooms. If pruning is delayed too long, growth may be reduced considerably, at least early in the season. Good pruning shears that will make clean cuts should be used. When pruning vigorous plants good loppers are easier and safer to use. The shape of the bush may be controlled to some extent by pruning to inside or outside buds, but varieties tend to have a characteristic shape which is not likely to be altered too much. Heavy gloves should be worn when pruning roses, and even then it is difficult to keep from getting stuck.



Top picture: Unpruned Radiance rose; Lower picture: Same bush pruned.

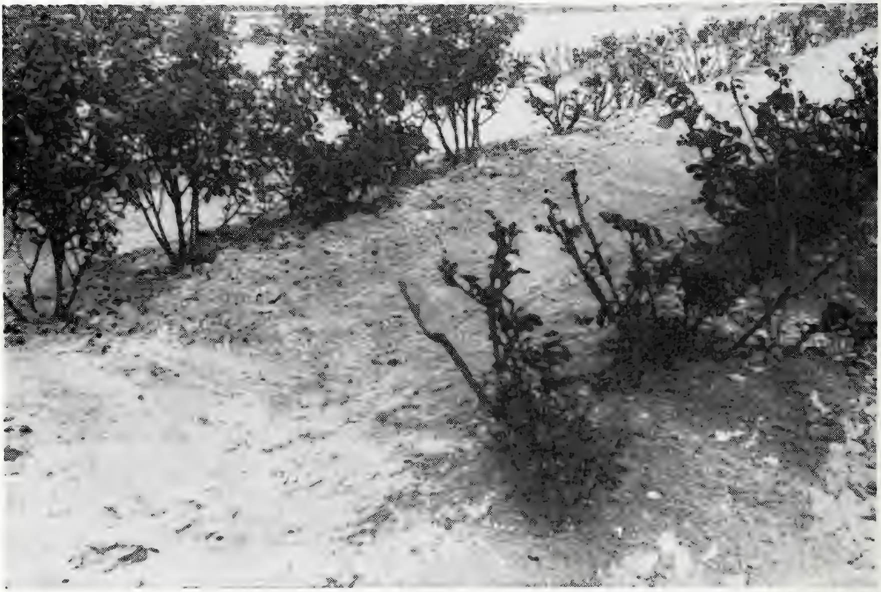
There is some variation of opinion as to the extent of the pruning that should be done. It should be remembered that in general pruning has a dwarfing effect on the plant. Its apparent stimulatory effect is due to the reduction of growing points, thus giving more vigorous shoots but not as many. Pruning of rose bushes is done to regulate the size of the plants and to increase the length of the stems of blooms. It also removes dead and dying canes. Four to eight healthy canes should be left per plant. Plants of vigorous varieties such as Radiance may be cut back at the winter pruning time to 12 to 15 inches from the ground. Most varieties should be cut back to from 18 to 20 inches from the ground if that much can be left. Weak growing plants should be pruned lightly.

In the South where vigorous growth has been made during the summer and bushes are tall and ragged looking, another general pruning should be made in mid-August. This is done to get the bushes in condition for the fall bloom. It should not be as severe as the winter pruning. Canes should be cut back to about 24 to 30 inches from the ground and some thinning out done.

Climbing Roses

Pruning of climbing roses is a little different from pruning bush roses. Early blooms are produced on canes of the previous year's growth

Pruned plants in fertilizer plots.



Large plants at left, unpruned, others pruned.

so that, if it is reduced extensively, the number of blooms will be decreased considerably. Pruning after the first bloom period is generally recommended. The spring bloom of hybrid perpetual climbers is the main bloom though there may be a light bloom in the fall. Climbing roses should be pruned sufficiently to keep them within the limits of the trellis or other support used. Some so-called climbing roses are really pillar roses, but they should be pruned similarly to real climbers.

Floribunda roses should be pruned according to vigor of growth and their adaptation to the general landscape design.

DISBUDDING

If flowers of exhibition varieties are to be grown for show purposes, they must be disbudded. This means that only one bud, the terminal, should be allowed to bloom per stem. The side buds should be removed when they are very small and can be easily removed without leaving noticeable scars. In a large rose planting proper disbudding will consume considerable time, but it greatly affects the quality of blooms produced. When quantity of blooms is more desired than quality, disbudding need not be practiced so carefully. Some varieties, such as Talisman, often have terminal buds that tend to be defective, in which case disbudding should not be done too thoroughly. There is a varietal difference in the way blooms are produced. Some tend to have few, if any, side buds, while others tend to bloom in clusters.

CUTTING BLOOMS

There is a common belief that rose blooms must be kept cut if the bush is to continue blooming profusely. This is not necessarily true. Blooms left on the bushes too long tend to be unsightly, and, if seed are allowed to set, their development will be a drain on the plant. Roses are grown primarily for cut flowers, and that means that they will be cut. Roses can be cut to such an extent that the bush will be injured. Very few blooms, if any, should be cut from the first crop after the plants are set out. When plants make a new growth, it is at the expense of reserve food in the plant. Leaves from the new growth if not removed replace the food used and add to it, thus helping to keep the plant in good condition and allowing it to grow. If too many blooms with their accompanying leaves are removed the plant will not grow as it should. Let the plant get well established before cutting the blooms too freely. Even established plants should not be cut severely enough, when removing blooms, to injure the plant materially. Cutting blooms, if properly done, is in reality a type of pruning and may prevent the bushes from growing out of bounds. The plants will likely thrive better if some of the blooms are enjoyed on the bushes. It is believed that another reason the bushes in the test garden have grown so well is that blooms were not cut when the plants were small. Probably one of the main reasons that rose bushes do not grow well or live long is that too much plant and leaves are removed with the blooms. Good plants are able to produce well the first year and then deteriorate rapidly. If plants could be replaced every year or two it would not make so much difference.

The best time of day to cut roses is now believed to be in the afternoon. This is because at that time there are more food reserves in the parts removed, and for that reason the flowers should keep better. It should be remembered, however, that during hot weather flowers open rapidly and what were buds in the morning may be full open blooms by late afternoon.

MULCHING

Proper mulching is beneficial to the rose garden. Materials such as pine straw, oak leaves, sawdust, bagasse, etc., may be used. The mulch should be no more than from 2 to 3 inches deep. It will help conserve moisture and tend to discourage weed and grass growth. When mulch materials decompose, they add organic matter to the soil. In the process of decomposition nitrogen is necessary, and mulching usually makes the addition of extra nitrogen beneficial.

IRRIGATION

While good drainage is absolutely essential for the successful growth of roses, the plants should not suffer for lack of water. This means that at certain times during the year watering will be beneficial. As with other plants, when roses are watered, the job should be done thoroughly; then wait about a week before it is repeated. Raised beds recommended for roses make the task of watering properly more difficult. If the water can be applied without wetting the leaves, leaf diseases will not spread as badly.

DISEASES AND INSECTS

Healthy, vigorous rose plants are necessary for the production of high quality flowers. To grow that type of rose plant, diseases and insects must either be prevented from attacking them or controlled when they appear. Badly diseased plants or those heavily infested with insects cannot make sufficient growth to produce good blooms, nor are they likely to live long.

The two most serious rose diseases that commonly occur in Louisiana are black spot and mildew. Black spot normally is the most injurious. Failure to control it is one of the main reasons for lack of success with roses.

Black spot is caused by a fungus. It usually occurs first on the leaves nearest the ground but will spread over the plant. The first noticeable symptoms are small purplish or dark gray spots on the leaves. These spots may increase in size and darkness of color. After a few days the area of the leaves surrounding the spots becomes yellow. These spots contain thousands of spores that can be spread, especially under moist conditions, by wind, insects and other means. Severe infections, if not checked, may cause complete defoliation of certain rose varieties.

Mildew is normally most troublesome during the early spring and in the fall when the weather is cool and relatively dry. It is generally not a serious problem during hot weather. Buds, stems and leaves infected with the organism that causes mildew have a whitish coating that is easily seen. Leaves frequently become curled and twisted after infection. The rambler type roses are so susceptible to mildew injury that they are not recommended in this area. Mildew is not controlled by many of the fungicides used to spray roses. Sulphur is one of the best materials to use. There is a relatively new material that is available now that is said to be excellent for mildew control. It was originally called Karathane, then Iscothan and now renamed Mildex. It is useful only for the control of mildew.

In general fungicides are protective materials and do not cure diseased portions of the plant. For best control it is essential that plants be sprayed or dusted with an effective fungicide before the disease organism attacks and that a protective covering be kept on the plants at all times. Proper treatment should prevent the spread of the organisms. Spraying the plants will usually give better disease control than dusting, because the material used will stay on the plants longer and will not wash off as easily. Dusting is often more easily and quickly done than spraying and for that reason is often preferred. It does, however, take more material. The residue left on the plant when a fungicide is applied is often objectionable. This is particularly true when fermate or one of the copper compounds is used. When a fungicidal spray is applied to plants in bloom, it should be kept off of the blooms as much as possible, if the blooms are to be cut.

If the following directions are followed, very good control of black spot should be obtained. After the rose plants are pruned in February, the pruned portions should be removed and burned. All leaves and other debris should be raked from the ground around the plants and burned. The pruned plants and the ground around them should then be sprayed with Bordeaux mixture or a similar copper compound. This should tend to prevent an early infection of disease organisms. When spring growth begins, the plants should be sprayed or dusted at intervals of one week with suitable fungicides. During periods of rainfall more frequent applications would likely be beneficial. It is important to have the spray or dust material on the plant before a rain and as soon after as possible. Tribasic copper sulphate used at the rate of 3 pounds to 50 gallons of water with a little soap powder or flakes used as a sticker has given good control of black spot in the L. S. U. experimental plots. This is at the rate of 1 ounce to 1.04 gallons of water. Some foliage injury can be expected from the use of copper compounds during cold, wet periods. If Bordeaux mixture is used, the standard 4-4-50 mixture (4 pounds bluestone, 4 pounds of lime and 50 gallons of water) is satisfactory. Fermate used at the rate of $\frac{1}{2}$ to $\frac{3}{4}$ pound to 50 gallons of water is effective against blackspot. Dithane Z-78 at the rate of $\frac{3}{4}$ to 1 pound per 50 gallons of water with a little soap sticker should be satisfactory. Manzate used at the rate of $\frac{3}{4}$ of a pound per 50 gallons of water, plus a sticker, has been used satisfactorily. The most generally recommended fungicide for roses at the present time is Captan. It should be used at the rate of 1 pound per 50 gallons of water. If small amounts of spray material are to be used, 1 tablespoon level full of Captan, Dithane Z-78 or manzate may be used per gallon of water. Wettable sulphur may be used as a spray. Sulphur used as a dust is effective against rose diseases if kept on the foliage. A mixture made of about 88 per cent sulphur and 12 per cent copper is a more effective dust. It is probably best to get such a mixture already made than for the individual to try to mix it. During very hot weather there is likely to be some damage to foliage caused by sulphur. The addition of sulphur to soil will lower the pH of the soil. If added in sufficient quantity, the soil will become too acid for rose plants to grow well. The accumulation of sulphur used as a dust may thus cause harmful soil acidity. This means that sulphur as a dust should be applied with a good duster and not used in excessive amounts. Late in the afternoon is probably the best time to apply dust. If the soil is too acid lime may be added. A soil sample should be sent to the Soil Testing Laboratroy and advice as to adding lime followed.

Crown gall is a bacterial disease that attacks the roots and crown of the rose and many other plants. It causes the formation of gall-like structures. If a plant has galls on the roots or crown, it should be destroyed rather than planted.

Chewing insects can be controlled best with market preparations of DDT, chlordane, or cryolite. It is impossible to prevent some damage to buds from night flying insects. Thrips are nearly always present in rose flowers. They are particularly harmful to white flowers. Thrips may prevent the proper opening of flowers of certain rose varieties, especially those that produce buds that have a very large number of petals. Thrips are a very difficult insect to control. The best control is to use DDT at the rate of 1 level tablespoon per gallon of water. Dieldrin may also be used for thrips at the rate of 5 cc per gallon. Aphids, often called plant lice, may cause considerable injury to the new growth of rose plants. They may literally cover the tips of growing shoots and buds. They are sucking insects and must be controlled by the use of a contact insecticide. Of the older materials, nicotine sulphate (Blackleaf 40) is one of the best to use for aphid control. It should be used at the rate of $1\frac{1}{2}$ to 2 teaspoons per gallon of water to which a little soap should be added. Nicotine sulphate spray is most effective when the temperature is relatively high. Malathion and Lindane are two of the newer materials that are effective in the control of aphids. Spray as often as aphids are found. Contact insecticides are not preventives, and must come into direct contact with the insects that are to be killed.

Rose plants are susceptible to nematode injury and are often seriously damaged. Plants should be free of nematodes when bought. About the only thing that can be done when plants in a rose planting are infested with nematodes is to give excellent care to the plants and hope that they will grow well in spite of the nematodes. Rose stocks resistant to nematodes have been used in some instances.

FLOWERS FOR SHOWS

In recent years there has been an increased interest among rose growers in the production of good specimen flowers for exhibition in rose and flower shows. The American Rose Society, local rose societies and garden clubs have been largely responsible for stimulating interest in this phase of rose culture. Competition between growers usually means that a better quality flower is produced for shows than would normally be grown.

In preparing a specimen hybrid tea, tea, or hybrid perpetual for exhibition the grower should begin three to four weeks prior to the time of the show. All flower buds on the stem except the terminal one should be removed soon after they have formed. The terminal bud should then make a larger flower.

Lateral or side buds on a specimen will cause it to be disqualified.

Roses are judged on form, substance, color, stem and foliage, and size. A high-centered or pointed rose is considered best for showing. Petals should be firm and fresh, not soft and wilted. The color should be typical of the variety. Stems should be straight and in proper proportion to the size of the flower. The foliage should not have any spray or dust residue, should be clean and not damaged by insects, diseases, wind or other causes.

The bloom should be as large or slightly larger than that normally produced by the variety. In the scale of points used in judging roses, size only counts 10 points; however, consciously or unconsciously, many judges appear to attach more importance to size than the scale of points indicates.

In general specimen blooms should be exhibited when one-half to three-fourths open. However blooms of some varieties are nearer perfection at an earlier stage and should be exhibited at that time. Specimens less than one-third open are considered as buds.

Blooms from varieties such as Eclipse should be exhibited when they are about one-third open to appear their best, while full double varieties like Peace are equally attractive when fully open.

Floribundas should not be disbudded for exhibiting in shows.

Flowers to be exhibited can be cut and placed in a refrigerator or cold storage two to three days prior to the show and still be shown.

ROSES FOR FENCES

Because of the publicity given the use of certain roses for fences and numerous inquiries that have been received, a little information on this subject might be helpful to some people. The multiflora rose is the one that has been generally used. There are many types of multiflora roses. As understock a thornless type is desirable. For fencing purposes stiff thorns and an erect vigorous type of growth are considered essential. The plants may grow 8 to 10 feet high and have a similar spread. Where land is plentiful and the plants will make proper growth an excellent living fence is evidently obtained. It also makes good cover for wildlife. This type of fence can not be recommended for use on the ordinary home lot, because of the space occupied. If it is used the suggested distance between plants is one foot. Under good conditions a fence should be established in two to three years.

CONCLUSION

Roses have been growing in the experimental plots at L. S. U. for six years and have definitely shown that many excellent varieties of roses can be successfully grown in south Louisiana. Some varieties have done better than others. Plants can not be judged by one period of bloom, but flower production and growth over several seasons should be considered. Many people are still likely to be disappointed with roses in their own yards because they may not be able to meet all the requirements necessary for excellent rose production or because some have been neglected. It isn't likely that anyone will do everything that should be done or do it always at the right time, but the more nearly it is done, the more likely the successful growing of roses will be accomplished. For emphasis, the following points, important for best success with roses, are stated again though they have been discussed in this bulletin:

1. Be sure that the rose bed has good drainage.
2. Have exposure to full sun if possible.
3. Prepare the soil well in advance of planting.
4. Get the best plants obtainable.
5. Plant varieties that are adapted to the area.
6. Set the plants at proper time of year and when the soil is not muddy.
7. Let the plants become well established before cutting blooms. Do not over cut.
8. Disbud when side buds are small.
9. Do not apply too much fertilizer.
10. Decomposed organic matter is beneficial.
11. Prune at proper times.
12. Irrigate thoroughly when necessary.
13. Control black spot and other diseases.
14. Control aphids, thrips and other insects.

The planting of roses should not be discouraged even though all qualifications can not be met. A rose garden that is only fair is far better than none at all.

Roses For The Yard

By
R. H. HANCHEY and W. D. KIMBROUGH

The Sutters Gold Variety

Bulletin No. 451 (Revised) February 1965

LOUISIANA STATE UNIVERSITY
and
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
Doyle Chambers, Director

CONTENTS

Page

- Introduction 3
- Rose Classification 3
    - Hybrid Teas 3
    - Hybrid Perpetuals 4
    - Polyanthas 4
    - Hybrid Polyanthas (Floribundas) 4
    - Grandiflora 4
    - Tree or Standard 5
    - Miniatures 5
    - Climbing Roses 5
    - Teas 6
- Varieties 6
- Grade of Plants To Buy 10
- Location 11
- Soil 11
- Spacing 12
- Planting 12
- Fertilizing 13
- Cultivating 15
- Propagating 16
    - Cuttings 16
    - Budding 17
    - Grafting 18
- Pruning 18
    - Bush Roses 18
    - Climbing Roses 20
- Disbudding 20
- Cutting Blooms 20
- Mulching 22
- Irrigating 22
- Diseases and Insects 23
- Flowers for Shows 26
- Roses for Fences 26
- Conclusions and Suggestions for Growing 27

Roses For The Yard

R. H. HANCHEY and W. D. KIMBROUGH

INTRODUCTION

There is no doubt that the rose is the most universally popular flower grown. There are many other beautiful flowers, such as the camellia, gladiolus, iris, daylily, narcissus and several other ornamental plants, that have many followers, but no other flower is a real rival of the rose. The fact that some kind of rose can be grown in most localities where any plant will thrive accounts for much of its widespread popularity. Its great range of types and colors, pleasing fragrance and unsurpassed beauty as a cut flower usually give it first consideration as a plant for home gardens. Here in the deep South it is possible to have roses in bloom in the open for a period of eight to nine months in a year. While the rose is generally grown as a cut flower, some types may be worked into a planned landscape. As the rose plant is a perennial, a rose bed properly cared for should be satisfactory for a number of years.

Experimental work was started with roses at the Louisiana Agricultural Experiment Station in January 1949. A progress report on results obtained is given in this bulletin. Other information is based on observations and experimental work done here and elsewhere.

ROSE CLASSIFICATION

The average rose grower considers all roses as being either bush or climbing types. There are, however, several classes of roses, some being satisfactory and some unsatisfactory as a group but having individual varieties of special merit within the group. Bush roses are generally divided into the following classes: hybrid teas, hybrid perpetuals, grandifloras, teas, polyanthas, hybrid polyanthas (floribundas), tree or standard, and miniature.

Hybrid Teas

Varieties of this class are of relatively recent origin and are the result of crosses between tea roses and hybrid perpetuals. This group is of far more importance than the other groups, as it contains most of the varieties commonly grown now. Practically all greenhouse roses sold by florists are of the hybrid tea group. They are classified as continuous bloomers, which means they bloom in cycles until stopped by unfavorable environmental conditions such as cold weather. The growth habits of the different varieties in this group vary, but generally speaking they range in height from two to six feet, with most being intermediate. They vary in form from the sprawling type of growth made by varieties like Crimson Glory to the upright growth of varieties like Texas Centennial. The foliage varies in color from the light green of Talisman to the dark green of Peace. Flower form may vary from the delicate single blossom of Dainty Bess to the full double of Briarcliff. Many of the hybrid teas are fragrant; others are not. Hybrid teas as a group are recurrent bloomers and are fairly vigorous growers.

Hybrid Perpetuals

The word perpetual in this case is very misleading. The hybrid perpetuals as a group are not perpetual bloomers, as their main blooming period is in the spring. During the time when they were most popular they came nearer to being perpetual bloomers than other types grown at that time. As a group they are of little importance today. American Beauty and Ulrich Brunner are varieties of this group. The variety Frau Karl Druschki is a hybrid perpetual and probably the best white variety for growing in Louisiana. The group as a whole grows vigorously and makes a stiff, upright type of growth and has dull green leaves and very double and somewhat flat blooms. They may or may not be fragrant.

Polyanthas

Plants of this group seldom grow over two feet in height. The flowers are small in size and borne in clusters. Fragrance is lacking in many varieties. Cecile Brunner (Sweetheart rose) and George Elger are examples of this group. This group is gradually being replaced by the hybrid polyanthas or floribundas.

Hybrid Polyanthas (Floribundas)

This class probably ranks second to the hybrid teas in importance at the present time. As a group they are similar to the true polyantha, but individual plants attain greater size. The blooms are borne in clusters and are generally larger than those of the polyanthas. The number of buds per cluster may vary considerably with different varieties. This is an important group of roses but cannot compare with the hybrid teas as a source of cut flowers or for exhibition purposes.

Grandiflora

In 1954 a new class of roses was added to the list. It is called grandiflora. It includes new rose varieties that have the following characteristics:

1. Plants of relatively tall growth.

2. Plants free flowering, often with many flowers in clusters but with individual stems long enough for cutting.
3. Flower size not necessarily as large as hybrid teas but larger than the average floribunda.
4. Hybrid tea standard for bud and flower form.

This class seemed necessary because of the production of hybrid roses that could not be easily classified in existing groups. Examples of varieties in this class are Queen Elizabeth and Roundelay. With the wide range of crossing that is being done in breeding work with roses, it is sometimes difficult to be sure about the proper classification of selections to be introduced.

The number of varieties in this group is increasing, though there are still not too many of them. In general, they are good varieties. There is still some question about whether this class is really necessary.

Tree or Standard

Very few tree roses are grown in Louisiana. Many people dislike the constant pruning that is necessary to keep the top of a tree rose in a pleasing shape and the staking of plants which is essential for their support. Where hard winds are likely to occur the stake must be a strong one. A tree or standard rose can be any variety of bush rose. Hybrid teas and floribundas are probably used most. A tree rose is produced by selecting a straight-stemmed cane and placing one or two buds of the desired variety in it two to six feet from the ground, depending on the height desired for the plant. Tree roses of many of the hybrid teas can be bought. The cost of propagation makes them more expensive than the same variety grown as a bush rose.

Miniatures

This class of roses is characterized by small flowers and small plants. The plants range in height from six to twelve inches and the blooms are less than an inch in size. As a group they are not too popular in Louisiana. Pixie, Midget and Tom Thumb are varieties of this class.

Climbing Roses

Roses that grow longer canes than bush roses are generally called "climbers." They may have a trailing type of growth or be more of an upright or pillar type. They may develop as climbers from seed or may be bud sports or mutations found on bush types.

There are climbers of many classes of bush roses. Many of the well-known varieties of roses may be obtained as either bush roses or climbing roses. Many varieties have been found by growers to be more satisfactory as climbers than as bush roses.

Generally speaking, climbing hybrid teas do not have as many blooming periods as the bush forms, but individual plants may produce many more blooms at one time. The additional foliage present on climbers and its distance from the ground make disease control more difficult than on bush types. Climbing roses could be of more importance in Louisiana than the number now planted indicates.

Teas

The tea group is characterized by small flowers, small leaves and growth that is usually not vigorous. They are normally recurrent bloomers until low temperatures induce dormancy. This group is of very little importance at the present time. Lady Hillingdon is one of the few varieties of this type still grown to some extent in Louisiana.

VARIETIES

One of the most important considerations when planning to plant a rose garden is the selection of proper varieties. There are hundreds of rose varieties, and the grower usually has to limit selections to only a few of them. Success with roses will depend to a great extent on the selection of varieties adapted to the area where they are to be grown. Varieties selected only from pictures in a catalogue can easily lead to disappointment. Varieties satisfactory under some conditions will not do under others. People may also differ as to what satisfies them when it comes to rose production. Indivdual preference in regard to color and shape should be taken into consideration. What may be considered excellent by one may be thought to be inferior by another. About 200 selected varieties have been tested at L.S.U. Of course there are many good varieties that have not been tried, but promising varieties are added each year. New rose varieties are constantly being developed by rose breeders. Most of the new varieties are being patented, which means they should not be propagated without authorization. The patent has run out on some of the older varieties and will expire on others every year. Bushes of non-patented varieties are usually more economical to buy.

When the ornamental program at the Louisiana Agricultural Experiment Station was started, it was known that many varieties could be grown in the northern part of the state, but there was considerable doubt about the probable success with roses, except for a few varieties, in the southern part of the state. Two or three years should be sufficient time to indicate whether varieties may be successfully grown in an area. The number of years that bushes may live and grow successfully will take more time to determine.

Experimental Roses at L.S.U.

Most yard gardeners are not interested in planting a large number of varieties. It is believed that it is better to plant three to six plants each of a few varieties than to set out one plant each of more varieties. In that way bouquets of a variety can be cut at one time.

There are four varieties of roses that have been recommended for planting in south Louisiana for several years. These varieties are Red and Pink Radiance, Etoile de Holland and Editor McFarland. After growing some of the newer varieties some people do not believe that Radiance roses should be recommended. It is believed, however, that in south Louisiana the two Radiance roses should still head the list of varieties to plant, for in this area they are the most vigorous growers and most dependable bloomers. They cannot compare with good specimens of many other varieties, but when other varieties are not available, the Radiance roses are very satisfactory. The shell pink Radiance, Mrs. Charles Bell, is fairly good but not in the class with the two Radiance roses recommended. Varieties are sometimes sold as White Radiance but there is no white rose in the class of the Red or Pink Radiance. The Etoile de Holland is a popular, old, red variety. It is a semi-double rose. The stems are sometimes not strong enough to hold the blooms up as they should. Editor McFarland is a very good pink rose. Its blooms are borne in clusters and require a lot of disbudding to produce specimen flowers. Bushes of this variety have been rather severely damaged by dieback in the experimental plots, and for that reason it is not highly recommended for planting.

The following hybrid tea roses are recommended as worthy of trial:

Peace—This is still the outstanding variety and belongs in a class by itself, though some of the newer varieties are giving it more competition. The color is somewhat variable but may be called cream with more or less pink tinting. Cooler temperatures seem to make the colors more intense. When fully open, it is a very large rose but, in spite of its size, is very beautiful. It does not have as many blooms per bush as some varieties, but it is really not a shy bloomer. It makes a vigorous growth and the stems are very large in diameter. Growers of this variety in Louisiana, however, have not been uniformly successful with it. The patent on it has run out. The climbing type has in general given good results. A number of mutations of Peace have been introduced, such as Chicago Peace, Speaker Sam, etc., but it is questionable whether they are as satisfactory as Peace.

There are a number of good red varieties on the market. Some of the better ones are as follows:

Chrysler Imperial—At the present time this is the most generally planted red rose. It is an excellent variety and has done well in the test plots.

Crimson Glory—For a number of years this was the most popular red variety. Large buds and flowers are produced in profusion but often on relatively short stems. It blooms a little later in the season than other red varieties mentioned. The plants tend to be low, spreading and thorny. The plants are long-lived.

Nocturne—One of the most beautiful red roses. Long, pointed buds are produced. The plant makes vigorous upright growth, but at times the stems may be a little weak. The color may fade in hot weather.

Mirandy—Another popular dark red rose. The buds are not pointed and are not very pretty until they are partly open.

Charlotte Armstrong and **Rubaiyat** are often called red but are really rose colored. Both are excellent varieties.

There are many pink rose varieties but not too many can be recommended. Some of those listed are pink blends.

Tiffany—This is one of the most highly recommended varieties.

Countess Vandal—Large, long, pointed buds are produced. The plant makes a more vigorous growth in north Louisiana than in the southern part of the state.

Picture—Blooms are not large but are very pretty and are produced in abundance.

The Doctor—Very large blooms are produced. A slight amount of shade will probably be beneficial to plants of this variety during hot weather.

Columbus Queen, Capistrano and **Duet** have been good varieties in the plots here.

Pink Lustre and **Pink Masterpiece**—The plants have been vigorous. Large, beautiful blooms are produced, but not too many of them.

There are still not too many real good yellow varieties for this area. A few will be listed. Most yellows are best in the bud stage.

Eclipse—This is recommended as the best yellow. Plants have grown well in the test plots but have not always been successful in home gardens.

Summer Sunshine—This is a very yellow rose. It is a fairly new variety and so far has done well in the test plots.

King's Ransom—This is a fairly good yellow variety.

There are a number of varieties that were called bicolors and are now called blends, some of which have done very well.

Granada—This is a new variety that seems to be an excellent one.

Helen Traubel, Sutters Gold, Garden Party and **La Jolla** have all been very good varieties.

A number of orange varieties have been introduced in the last few years.

Tropicana—The blooms are often not too large, but this seems to be an outstanding variety.

Tanya and **Aztec** have both done well.

There have been no really good white varieties tested here that can be recommended for this area. **Virgo, K. A. Victoria** and **Caledonia** have been as good as any.

Two white varieties have been introduced recently. They will be mentioned though they have been in the test only one year. **John F. Kennedy** looks very promising, but it will take a few years to be sure. **White Beauty,** a mutation of **The Doctor,** should be very good, if it will do as well as the original variety.

Most of the grandiflora varieties tested have done very well. A few will be listed.

Queen Elizabeth—One of the best pinks in any class.

Montezuma—An excellent orange-red variety.

Roundelay and **Starfire** are both good reds.

Golden Girl—This is a pretty fair yellow.

El Capitan and **Audie Murphy** have grown and bloomed well. The buds are beautiful, but the open flowers are not much.

Quite a number of floribunda varieties have been tested. As a group they have done well. The following are some of those that have done well: Betsy McCall, Fanfare, Fashion, Fashionette, Floriade, Frolic, Fusilier, Ginger, Golden Slippers, Heat Wave, Ivory Fashion, Lilli Marleen, Malibu, Pink-A-Boo, Pink Chiffon, Ruby Lips, Saratoga, Spartan, Summer Snow and White Bouquet.

GRADE OF PLANTS TO BUY

Rose bushes are usually sold in three grades—No. 1, No. 1½ and No. 2. The No. 1 grade is the largest size and is the one recommended for planting. The size of No. 1 bushes will vary to some extent with the vigor of the variety. The more vigorous ones should have at least three canes. The best two-year-old, field-grown plants should be obtained for planting. They should be free of crown gall, which is often found on rose bushes, though such plants should not be passed for sale by inspectors. Quality of rose bushes should not be sacrificed for bargain prices. If it is possible, plants that have gone into a normal dormancy should be obtained. Orders for plants should be placed early in the season to help insure obtaining the varieties desired. The time delivery is wanted should be specified when the order is placed. When the plants are received, they should be unpacked immediately and either planted or heeled in until they can be set out.

A number of rose plants are now grown and offered for sale in containers. In general these plants are smaller than field-grown plants. They may be transplanted at any time, provided that the soil remains intact when the container is removed and the plant set out.

The container plants have the advantage of no root pruning at planting time, but the roots are restricted to the container area. Some field-grown rose plants are put into containers by retailers. This usually requires more root pruning than if plants were set directly in the open.

No particular source of plants can be recommended. Plants in the test plots have come from several sources in various parts of the United States. Good, healthy plants of suitable varieties from all sources have done well. The important thing is to get good plants of varieties that are adapted to the area where they are to be grown. Cheap plants are often not a bargain, but a high price does not insure getting a good plant.

LOCATION

Good drainage is imperative if roses are to be grown successfully. This does not merely mean surface runoff of water, but that water will percolate through the soil so that it will not stay waterlogged. If the soil is poorly drained because of an impervious layer near the surface, it is not suitable for planting roses. Under such conditions merely digging a pit and putting gravel in the bottom will do no good unless the depth is sufficient to go through the portion of soil preventing good drainage and allow the water to go through it. When drainage is not too good, raising the level of the rose bed should be beneficial. Even where drainage is thought to be good, raising the level of the rose bed may often be beneficial.

A location exposed to full sun is best for the rose garden. If such a site is not available, place the rose garden where it will get as much sunshine as possible. During the hottest part of the summer a little shade might be beneficial so far as color of blooms is concerned, but in the spring and fall it will not. Too much sun causes the color to fade.

Hybrid tea roses are grown almost exclusively for cut flowers, and the rose garden is usually not too pretty from the landscape standpoint. This means that, where choice can be exercised, the rose garden should not be located in a prominent place, such as the front yard.

Many climbers, floribundas, and rose species may, however, be used as landscape material, as their type of growth and blooming habits may be well adapted for this purpose.

SOIL

Roses are grown successfully on a wide range of soil types. In the average yard the grower does not have much choice. If a choice can be made, a loam soil with a porous clay subsoil is probably ideal. A mildly acid soil is best for roses, with a pH range of 6.0 to 6.5 probably being best.

SPACING

Because of lack of space or the desire to plant too many bushes, plants are often set out much too close together. If good growth is expected, plants must have ample space in which to grow. Three feet between plants in the row is a good spacing to use, and the distance between rows should be 4 to 5 feet. It is believed that one of the reasons why roses have grown so well in the experimental plots is that they have not been too crowded. It is best for rose plantings to be in double rows rather than in three or more, so that they are more accessible for cutting blooms, dusting or spraying, pruning, etc. Less vigorous varieties, especially floribundas, may be spaced more closely than the more vigorous ones. Even these should not be spaced closer than 2 to 2½ feet in the row.

PLANTING

The best time to set out roses may vary from year to year, though it should be done in the dormant season. General recommendations must of necessity be a sort of compromise. In the South root growth often takes place though the above-ground parts may be dormant. Plants should be set out in time for the root system to become somewhat established before active growth starts in the spring. If set out early and there is a period of mild weather, growth may start in the above-ground parts and then, if a severe cold comes, plants may be damaged or killed. This happened in February 1951. If plants are set late in the dormant season, poor growth usually occurs at least for a time.

January is probably the best time to plant roses in south Louisiana and February in north Louisiana. If dormant plants can be obtained in December they might be all right for setting then in north Louisiana, provided they are not damaged by cold later on. Most rose plants are sold bare rooted and should be dormant when they are set out. The rose bush apparently does not have a true rest period, and after the bushes are set out, they will grow when conditions are favorable for growth. If plants are set out in Louisiana in October or November, they are sure to start growth before low temperatures retard such growth. Such young growth may then be damaged by cold, or inferior blooms produced out of season may use reserve food in the plant to such an extent that growth will not be normal when spring comes: This happened to plants set out in January of 1950 at Baton Rouge because of a more open winter than is usual for this area.

Plants should be set out when the soil can be worked well. Do not plant when the soil is wet and soggy because under such conditions it is impossible to do a good job of planting. Preparation of beds should be begun well ahead of time of planting. Even a year ahead is not too long. The bed should be raised if necessary and a considerable amount of organic matter worked into the soil. This may be a green-manure crop, leaves or manure of some kind. In any case the organic matter should be well decomposed before time to plant the bushes. Holes should be dug large enough to allow the roots to be spread in a normal position. A mound or cone of soil built in the hole is often better than trying to push soil under the roots. The plant should be set at a depth that allows the crown of the plant to be at or just beneath the surface after the soil has settled. If the plant is set too high, it will likely be damaged by wind or blown over. After the roots have been properly spread in the hole, surface soil alone or with some leaf mold should be added first as it will be in contact with the roots. As more soil is added, it should be packed well around the roots. When the hole is nearly filled, the plant should be watered well. After the water settles, finish filling the hole with soil that is not muddy. It may be mounded slightly around the plant temporarily, but no further packing is necessary.

Experienced growers might use a small amount of commercial fertilizer at planting time, but it would probably be better to wait and fertilize properly later. Many plants are damaged or killed by the use of too much fertilizer at planting time.

No pruning should be necessary at time of planting, but it may be done if essential.

FERTILIZING

There are a number of elements that are essential for plant growth. Most of these elements are obtained from the soil, some in very small quantities. If all of the essential elements that come from the soil are present in a form available to the plant and in sufficient quantity to meet the needs of the plant, no fertilizer need be added. Usually soils in the South are deficient in one or more of these elements. It is to supply these deficiencies that fertilizers are added.

Information concerning the fertilizer needs of roses is not too conclusive. Work at Cornell University indicates that the nitrate level in the soil solution should be from 25 to 100 parts per million. This means that it is possible to have too much as well as too little available nitrogen present.

A fertilizer experiment was started with roses at the Louisiana Agricultural Experiment Station in February 1949. There are 12 plants in each plot, two each of Red Radiance, Editor McFarland, Etoile de Holland, Countess Vandal, Crimson Glory and Eclipse. The plants were spaced 3 feet in the row and 6 feet between rows. Each treatment was replicated three times. The soil type is Lintonia silt loam.

The following treatments were used:

Check—no fertilizer
Chicken manure at the rate of 10 tons per acre
Chicken manure at the rate of 10 tons per acre + ⅛ lb. 8-8-8 per plant
Chicken manure at the rate of 10 tons per acre + ⅛ lb. 8-8-8 per plant + ⅛ lb. nitrate of soda per plant in August
Barnyard cow manure at the rate of 20 tons per acre
Barnyard cow manure at the rate of 20 tons per acre + ⅛ lb. 8-8-8 per plant
Barnyard cow manure at the rate of 20 tons per acre + ⅛ lb. 8-8-8 per plant + ⅛ lb. nitrate of soda per plant in August
Cottonseed meal at the rate of 2,000 lbs. per acre
Cottonseed meal at the rate of 2,000 lbs. per acre + ⅛ lb. nitrate of soda per plant in August
8-8-8 at the rate of ⅛ lb. per plant
8-8-8 at the rate of ¼ lb. per plant
8-8-8 at the rate of ¼ lb. per plant + ⅛ lb. nitrate of soda per plant in August
8-8-8 at the rate of ¼ lb. per plant + ⅛ lb. nitrate of soda per plant in August + esminel at rate of ⅓ oz. per plant

In 1951 the rates of 8-8-8 per plant were increased from ⅛ and ¼ pound per plant to ¼ and ½ pound per plant.

For three years there was very little difference in growth of plants on any of the plots regardless of fertilizer treatment. All made good growth and bloomed well. Plants on plots that received no fertilizer were only slightly behind and those on plots that received manure were slightly ahead of the plants on the other plots. The addition of fertilizer made no noticeable difference where manure had been applied. The difference in the rate of application of 8-8-8 made no difference. There was no apparent damage to plants from any of the fertilizer treatments.

After 12 years the plants on the plots that received no fertilizer are poor in comparison with those on the better fertilized plots. However, they still produce many beautiful blooms each year.

Plants on plots that received either type of manure have a definite superiority. The addition of commercial fertilizer to plots that received manure has shown no benefit to date Plants on plots that received cottonseed meal are not superior to those that received 8-8-8. The addition of nitrogen to plots in mid-August gave some stimulation to plant growth after the fourth year.

The results obtained so far from the fertilizer test show that there is a definite response of the rose bush to the application of fertilizer, but that the rose does not need fertilizer in amounts often applied nor as frequently as it is often given. The application of manure has definitely been beneficial. Well-decomposed manure should be used. However, it should be remembered that when manure is used, weeds are usually more of a problem. The manure should be broadcast uniformly over the rose bed.

The best time to apply fertilizer is in late winter. This would be about the middle of February in south Louisiana. It should be applied broadcast in an area extending about 18 inches in every direction from the crown of the plant. The fertlizer should be evenly distributed over the area. It is best to work the fertilizer into the soil around the plants. Only a rather general suggestion can be given as to the amount to apply, and that is from ⅛ to ¼ pound of 8-8-8 fertilizer per plant or its equivalent. Any good complete fertilizer may be used. The rate of application of a complete fertilizer is usually based on the nitrogen content. That would mean that half as much fertilizer that contains 8 per cent N should be used as one containing only 4 per cent N. In good soil one application of complete fertilizer per year should be sufficient. An application of nitrate of soda or its equivalent at the rate of 1 to 2 ounces per plant in August may be beneficial for the fall blooms. In very sandy soils additional nitrogen may be beneficial, but it should not be applied late enough to stimulate growth that might be subject to winter injury. Fertilizer should be used with caution, for it may be that more rose bushes have been damaged by the use of excessive amounts than from its lack. It is believed, however, that in the South the use of some fertilizer will, under most conditions, be beneficial.

CULTIVATING

The main reasons for cultivation are to control weeds and grass and to prevent the soil from becoming too compact. Roses cannot be grown successfully in a compact soil. Aside from being unsightly, weeds and grass compete with the rose plants for water and essential elements that are obtained from the soil. If the soil becomes too compact the plant may suffer because of insufficient oxygen to supply the needs of the roots. The main cultivation should be given right after the winter pruning and just prior to the application of fertilizer. Only light cultivation should be given the rest of the year, so as not to damage the roots of the rose plants unnecessarily.

PROPAGATING

Cuttings

Most of the common varieties of roses can be propagated by cuttings. A rose propagated from a cutting is own-rooted; it has developed roots from its own tissues.

Information on the longevity of the newer and many of the older varieties of hybrid teas on their "own roots" is not available. Some of the older hybrid tea varieties do well on their own roots. In Baton Rouge there are a few Pink and Red Radiance plants growing and flowering well that were propagated by cuttings 21 years ago. It is quite possible that many varieties will perform satisfactorily on their own roots. It takes from two to four years to produce a desirable plant from a cutting, but apparently some varieties do not do well when own-rooted. Experiments are in progress in the ornamental research program at the Louisiana Agricultural Experiment Station to test own-rooted roses versus budded roses and to get information on the best stocks to use for budding roses to be grown under Louisiana conditions.

The following rose varieties propagated from cuttings have grown satisfactorily for several years in experimental plots: Peace, Mirandy, Nocturne, Charlotte Armstrong, Red Radiance, Eclipse, Countess Vandal, Etoile de Holland and Crimson Glory.

Cuttings can be made from roses during the growing season, or during the dormant season. If cuttings are taken during the growing season, they are semi-hardwood cuttings and can be made from a stem just before blooming, at the time of bloom, or just after blooming. Semi-hardwood cuttings root best if given special attention. Fair results can be expected if cuttings are treated as follows: Use a cutting box with 6-inch sides that has holes in the bottom for drainage. Cover the holes with an inch of gravel or broken pottery. Use a mixture of ½ sand plus ½ vermiculite by volume or sand alone as a rooting medium. A mixture of ½ peat and ½ sand is also satisfactory. Cover the cutting box with unbleached sheeting so that the sheeting will be around 24 to 30 inches above the sides of the cutting box. Place the cutting box in a shaded place and water down well. The cuttings should be 5 to 7 inches in length and the basal cut should be made just below a bud. The upper leaves should be left on the cutting. Dip the basal end of the cutting in one of the commercial root-inducing materials. Those that have the weaker concentrations should be used and not the ones sold to be used on plants that are hard to root. Then place the cutting in the cutting bed, leaving 2 to 3 inches of the cutting exposed above the rooting medium. Keep the rooting medium moist, never allowing it to dry out.

Hardwood cuttings are generally taken during December, January and February after the plants are defoliated. Cuttings 8 to 10 inches in length about the size of or slightly larger than a lead pencil are used. These should be placed about 4 inches apart in well-prepared and well-drained rows. Root stimulants are probably of no value on hardwood cuttings. Hardwood cuttings should be placed deep in the soil with only two buds exposed. This is an excellent method for obtaining plants to be used as an understock for budding. During most seasons a covering or other protection is not necessary for hardwood cuttings in Louisiana.

Budding

Practically all roses sold for outdoor growing have been budded. The T or shield method of budding is used. It is the same method that is used in propagating citrus and peaches. Multiflora, Ragged Robin, Odorata, Manetti, Dr. Huey, IXL and others are used as understock for budding. In budding, the understock furnishes the root system, and the bud or scion placed in it forms the top of the plant. Buds on the lower part of the cuttings to be used as stocks should be removed to prevent growth from the stock after propagation.

When the understock attains the size of one-fourth to six-sixteenths of an inch in diameter it is large enough to bud. Budding can be done at any time the bark will slip. The technique involved in budding roses is simple. A T-cut about an inch in length is made through the bark as low as possible on the understock. A bud that has been cut in a shield shape is then inserted into the T-cut. The bud should come from wood that is not succulent or that is not too hard. The cut on individual buds should start one-half inch below the bud and stop one-half inch above it. A portion of the leaf petiole can be left on the bud to aid in placing the bud in the T-cut slit. The bud is inserted into the slit at the top of the T after the sides of the upper portion of the T have been peeled open. After proper placement of the bud the complete area below and above the bud should be wrapped with rubber budding strips, raffia or cotton twine. The bud itself should not be covered with the wrapping material. If the bud is green two weeks after budding, the chances are it has "taken." If twine or raffia was used in wrapping, it should be removed at this time. If rubber strips were used, they will rot and not girdle the bud.

If the budding operation is performed in the spring, the understock can be cut off just above the bud as soon as it has taken. If the budding is done in late summer, it is better to wait until the following spring to remove the part of the understock above the bud. Late summer or fall removal might force the bud into growth that would be injured by winter temperature.

Good plants have been produced here on all of the following understock: Multiflora, Ragged Robin, Dr. Huey, IXL, Manetti and Odorata. Only a limited number of plants have been grown so far; no one understock has shown superiority.

Grafting

Many of the greenhouse roses grown for cut flowers are grafted. The splice graft or whip graft is usually used on small stock. Most outdoor roses are budded rather than grafted.

Healthy, vigorous outdoor plants that produce undesirable flowers could be grafted successfully with desirable types. Either bark or cleft grafting could be used. Bark grafting should be done in early spring just after growth begins at a time when the bark will slip. A slanting cut of 1 to 1½ inches should be made on a dormant scion and the scion should be inserted into a T-slit made near the ground on the stock. After the scion begins growth the stock above the scion can be removed with a knife or pruning shears.

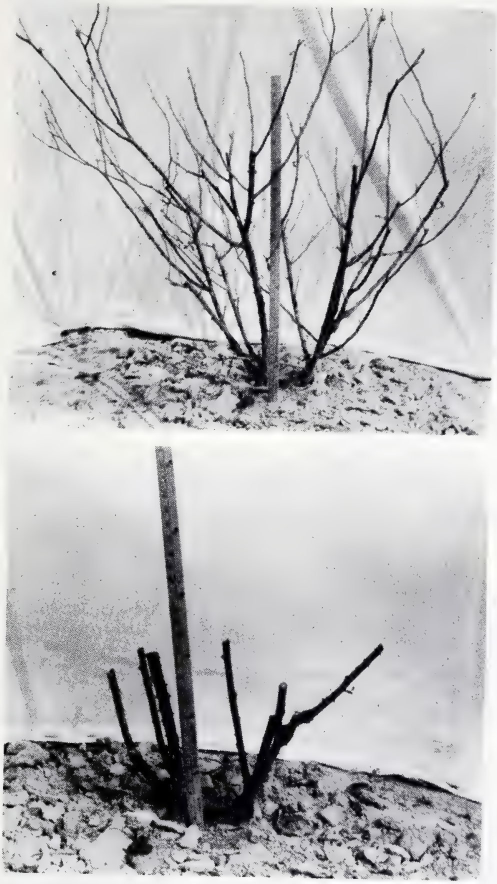
In cleft grafting the stock should be cut off 2 to 3 inches above the ground and a 2-inch slit made in the middle of the stock. Dormant scions 4 inches to 6 inches in length should be cut at the basal end in a wedge shape. The scions should then be inserted into the cleft.

Care should be taken in matching the cambium of the stock and scion. The cut portion of the graft should be treated with one of the wound healing materials such as Tree Kote, Tree Seal or a similar preparation. Cleft grafting would be more successful if done during the latter part of the dormant season, usually early February in Louisiana.

PRUNING

Bush Roses

The recommended time for pruning roses in Louisiana is in February. In general the later in the season pruning is done, the later will be the first crop of blooms. As soon after pruning as weather conditions permit, new growth will start on the plants, and it may be damaged by severe cold following growth. That is the risk taken when pruning is done in December or January. The grower will have to use his own judgment as to how much chance he wants to take to get very early blooms. If pruning is delayed too long, growth may be reduced considerably, at least early in the season. Good pruning shears that will make clean cuts should be used. When pruning vigorous plants good lopping shears are easier and safer to use. The shape of the bush may be controlled to some extent by pruning to inside or outsde buds, but varieties tend to have a characteristic shape which is not likely to be altered too much. Heavy gloves should be worn when pruning roses, and even then it is difficult to keep from getting stuck.



Top picture: Unpruned Radiance rose; Lower picture: Same bush pruned.

There is some variation of opinion as to the extent of the pruning that should be done. It should be remembered that, in general, pruning has a dwarfing effect on the plant. Its apparent stimulatory effect is due to the reduction of growing points, thus giving more vigorous shoots but not as many. Pruning of rose bushes is done to regulate the size of the plants and to increase the length of the stems of blooms. It also removes dead and dying canes. Four to eight healthy canes should be left per plant. Plants of vigorous varieties such as Radiance may be cut back at the winter pruning time to 12 to 15 inches from the ground. Most varieties should be cut back to from 18 to 20 inches from the ground if that much can be left. Weak growing plants should be pruned lightly.

In the South when vigorous growth has been made during the summer and bushes are tall and ragged looking, another general pruning should be made in mid-August. This is done to get the bushes in condition for the fall bloom. It should not be as severe as the winter pruning. Canes should be cut back to about 24 to 30 inches from the ground and some thinning out done.

Climbing Roses

Pruning of climbing roses is a little different from pruning bush roses. Early blooms are produced on canes of the previous year's growth so that, if it is reduced extensively, the number of blooms will be decreased considerably. Pruning after the first bloom period is generally recommended. The spring bloom of hybrid perpetual climbers is the main bloom though there may be a light bloom in the fall. Climbing roses should be pruned sufficiently to keep them within the limits of the trellis or other support used. Some so-called climbing roses are really pillar roses, but they should be pruned similarly to real climbers.

Floribunda roses should be pruned according to vigor of growth and their adaptation to the general landscape design.

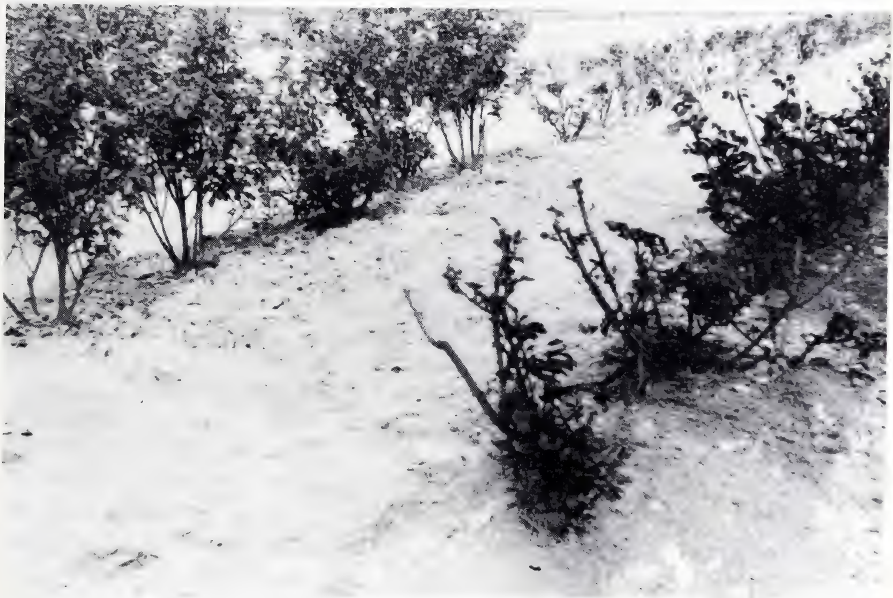
DISBUDDING

If flowers of exhibition varieties are to be grown for show purposes, they must be disbudded. This means that only one bud, the terminal, should be allowed to bloom per stem. The side buds should be removed when they are very small and can be easily removed without leaving noticeable scars. In a large rose planting proper disbudding will consume considerable time, but it greatly affects the quality of blooms produced. When quantity of blooms is more desired than quality, disbudding need not be practiced so carefully. Some varieties, such as Talisman, often have terminal buds that tend to be defective, in which case disbudding should not be done too thoroughly. There is a varietal difference in the way blooms are produced. Some tend to have few, if any, side buds, while others tend to bloom in clusters.

CUTTING BLOOMS

There is a common belief that rose blooms must be kept cut if the bush is to continue blooming profusely. This is not necessarily true. Blooms left on the bushes too long tend to be unsightly, and, if seed are allowed to set, their development will be a drain on the plant. Roses are grown primarily for cut flowers, and that means

Pruned plants in fertilizer plots.



Large plants at left, unpruned, others pruned.

that they will be cut. But roses can be cut to such an extent that the bush will be injured.

Very few blooms, if any, should be cut from the first crop after the plants are set out. When plants make a new growth, it is at the expense of reserve food in the plant. Leaves from the new growth, if not removed, replace the food used and add to it, thus helping to keep the plant in good condition and allowing it to grow. If too many blooms with their accompanying leaves are removed the plant will not grow as it should. Let the plant get well established before cutting the blooms too freely. Even established plants should not be cut severely enough, when removing blooms, to injure the plant materially. Cutting blooms, if properly done, is in reality a type of pruning and may prevent the bushes from growing out of bounds. The plants will likely thrive better if some of the blooms are enjoyed on the bushes. It is believed that another reason the bushes in the test garden have grown so well is that blooms were not cut when the plants were small. Probably one of the main reasons that rose bushes do not grow well or live long is that too much plant and leaves are removed with the blooms. Good plants are able to produce well the first year and then deteriorate rapidly. If plants could be replaced every year or two it would not make so much difference.

The best time of day to cut roses is now believed to be in the afternoon. This is because at that time there are more food reserves in the parts removed, and for that reason the flowers should keep better. It should be remembered, however, that during hot weather flowers open rapidly and what were buds in the morning may be full open blooms by late afternoon.

MULCHING

Proper mulching is beneficial to the rose garden. Materials such as pine straw, oak leaves, sawdust, bagasse, etc., may be used. The mulch should be no more than from 2 to 3 inches deep. It will help conserve moisture and tend to discourage weed and grass growth. When mulch materials decompose, they add organic matter to the soil. In the process of decomposition nitrogen is necessary, and mulching usually makes the addition of extra nitrogen beneficial.

IRRIGATING

While good drainage is absolutely essential for the successful growth of roses, soil water should always meet the plants' needs. This means that at certain times during the year watering will be beneficial. As with other plants, when roses are watered, the job should be done thoroughly; then wait about a week before it is repeated. Raised beds recommended for roses make the task of watering properly more difficult. If the water can be applied without wetting the leaves, leaf diseases will not spread as badly.

DISEASES AND INSECTS

Healthy, vigorous rose plants are necessary for the production of high quality flowers. To grow that type of rose plant, diseases and insects must either be prevented from attacking them or controlled when they appear. Badly diseased plants or those heavily infested with insects cannot make sufficient growth to produce good blooms, nor are they likely to live long.

In general, fungicides are protective materials and do not cure diseased portions of the plant. For best control it is essential that plants be sprayed or dusted with an effective fungicide before the disease organism attacks and that a protective covering be kept on the plants at all times. Proper treatment should prevent the spread of the organisms. Spraying the plants will usually give better disease control than dusting, because the material used will stay on the plants longer and will not wash off as easily. Dusting is often more easily and quickly done than spraying and for that reason is often preferred. It does, however, take more material. The residue left on the plant when a fungicide is applied is often objectionable. This is particularly true when fermate or one of the copper compounds is used. When a fungicidal spray is applied to plants in bloom, it should be kept off of the blooms as much as possible, if the blooms are to be cut.

The two most serious rose diseases that commonly occur in Louisiana are black spot and mildew. Black spot normally is the most injurious. Failure to control it is one of the main reasons for lack of success with roses.

Black spot is caused by a fungus. It usually occurs first on the leaves nearest the ground but will spread over the plant. The first noticeable symptoms are small purplish or dark gray spots on the leaves. These spots may increase in size and darkness of color. After a few days the area of the leaves surrounding the spots becomes yellow. These spots contain thousands of spores that can be spread, especially under moist conditions, by wind, insects and other means. Severe infections, if not checked, may cause complete defoliation of certain rose varieties.

If the following directions are followed, very good control of black spot should be obtained. After the rose plants are pruned in February, the pruned portions should be removed and burned. All leaves and other debris should be raked from the ground around the plants and burned. The pruned plants and the ground around them should then be sprayed with Bordeaux mixture or a similar copper compound. This should tend to prevent an early infection of disease organisms. When spring growth begins, the plants should be sprayed or dusted with suitable fungicides at intervals of one week. During periods of rainfall more frequent applications would likely be beneficial. It is important to have the spray or dust material on the plant before a rain and as soon after as possible.

There are a number of materials that may be used for the control of black spot on roses. Some of the materials are fairly new, while others have been on the market for some time. It is likely that other materials will be developed. At the present time Phaltan is the one most generally recommended for control of black spot. It will also help control mildew. Manzate is also an excellent material to use. Other materials that may be used are Dithane Z-78, Captan, Fermate and Tribasic copper sulphate. Bordeaux mixture may also be used. Sulphur-copper dust (88 per cent to 12 per cent) has also been used.

In very hot weather sulphur may cause some burning, and in cool weather copper may cause such injury. Some damage may be caused at times by the other materials that have been recommended. It may be best to change from one material to another from time to time. Follow the directions of the manufacturer as to amounts to use. In making small amounts of spray solution, usually one tablespoonful of such materials as Phaltan, Manzate and Captan is used per gallon of water. It may be best not to use a spreader-sticker material with Phaltan on roses.

The addition of sulphur to soil will lower the pH of the soil. If added in sufficient quantity, the soil will become too acid for rose plants to grow well. The accumulation of sulphur used as a dust may thus cause harmful soil acidity. This means that sulphur as a dust should be applied with a good duster and not used in excessive amounts. Late in the afternoon is probably the best time to apply dust. If the soil is too acid, lime may be added. A soil sample should be sent to the Soil Testing Laboratory and advice as to adding lime followed.

Mildew is normally most troublesome during the early spring and in the fall when the weather is cool and relatively dry. It is generally not a serious problem during hot weather. Buds, stems and leaves infected with the organism that causes mildew have a whitish coating that is easily seen. Leaves frequently become curled and twisted after infection. The rambler type roses are so susceptible to mildew injury that they are not recommended in this area. Mildew is not controlled by many of the fungicides used to spray roses. Sulphur is one of the best materials to use. There are two materials now available that are excellent for the control of mildew. One is Mildex and the other is Acti-dione PM.

Rust has not been considered to be a serious problem on roses in Louisiana. In recent years, however, there have been rather severe attacks of this disease in the test plots. It may become more of a problem. Weather conditions affect its spread, as it is usually not serious in hot or dry weather. There is a difference in varietal susceptibility to rust. Rust is not too easy to control. Sulphur is the best material to use. Fermate or Parzate may also be used.

Crown gall is a bacterial disease that attacks the roots and crown of the rose and many other plants. It causes the formation of gall-like structures. If a plant has galls on the roots or crown, it should be destroyed rather than planted.

Chewing insects can be controlled best with market preparations of DDT, chlordane or cryolite. It is impossible to prevent some damage to buds from night-flying insects. Thrips are nearly always present in rose flowers. They are particularly harmful to white flowers. Thrips may prevent the proper opening of flowers of certain rose varieties, especially those that produce buds that have a very large number of petals. Thrips are a very difficult insect to control. The best control is to use DDT at the rate of 1 level tablespoon per gallon of water every other day. Dieldrin may also be used for thrips at the rate of 5 cc. per gallon. Aphids, often called plant lice, may cause considerable injury to the new growth of rose plants. They may literally cover the tips of growing shoots and buds. They are called sucking insects and must be controlled by the use of a contact insecticide. Of the older materials, nicotine sulphate (Blackleaf 40) is one of the best to use for aphid control. It should be used at the rate of 1½ to 2 teaspoons per gallon of water to which a little soap should be added. Nicotine sulphate spray is most effective when the temperature is relatively high. Malathion and Lindane are two of the newer materials that are effective in the control of aphids. Spray as often as aphids are found. Mites are also serious pests of roses at times. They may be controlled by the use of Aramite, Kelthane, Tedion or Malathion. Contact insecticides are not preventives; they must come into direct contact with the insects to be killed. Cygon is now being used as a spray for roses. It should be effective for mites and aphids and maybe thrips.

Rose plants are susceptible to nematode injury and are often seriously damaged. Plants should be free of nematodes when bought. About the only thing that can be done when plants in a rose planting are infested with nematodes is to give excellent care to the plants and hope that they will grow well in spite of the nematodes. Rose stocks resistant to nematodes have been used in some instances.

FLOWERS FOR SHOWS

In recent years there has been an increased interst among rose growers in the production of good specimen flowers for exhibition in rose and flower shows. The American Rose Society, local rose societies and garden clubs have been largely responsible for stimulating interest in this phase of rose culture. Competition between growers usually means that a better quality flower is produced for shows than would normally be grown.

In preparing a specimen hybrid tea, tea, or hybrid perpetual for exhibition the grower should begin three to four weeks prior to the time of the show. All flower buds on the stem except the terminal one should be removed soon after they have formed. The terminal bud should then make a larger flower.

Lateral or side buds on a specimen will cause it to be disqualified.

Roses are judged on form, substance, color, stem and foliage, and size. A high-centered or pointed rose is considered best for showing. Petals should be firm and fresh, not soft and wilted. The color should be typical of the variety. Stems should be straight and in proper proportion to the size of the flower. The foliage should not have any spray or dust residue, should be clean and not damaged by insects, diseases, wind or other causes.

The bloom should be as large or slightly larger than that normally produced by the variety. In the scale of points used in judging roses, size only counts 10 points; however, consciously or unconsciously, many judges appear to attach more importance to size than the scale of points indicates.

In general, specimen blooms should be exhibited when one-half to three-fourths open. However, blooms of some varieties are nearer perfection at an earlier stage and should be exhibited at that time. Specimens less than one-third open are considered as buds.

Blooms from varieties such as Eclipse should be exhibited when they are about one-third open to appear their best, while full double varieties like Peace are equally attractive when fully open.

Floribundas should not be disbudded for exhibiting in shows. It is not necessary to disbud grandiflora roses for show purposes.

Flowers to be exhibited can be cut and placed in a refrigerator or cold storage two to three days prior to the show and still be shown.

ROSES FOR FENCES

Because of the publicity given the use of certain roses for fences and numerous inquiries that have been received, a little information on this subject might be helpful to some people. The multiflora rose is the one that has been generally used. There are many types of multiflora roses. As understock a thornless type is desirable. For fencing purposes stiff thorns and an erect vigorous type of growth are considered essential. The plants may grow 8 to 10 feet high and have a similar spread. Where land is plentiful and the plants will make proper growth an excellent living fence is evidently obtained. It also makes good cover for wildlife. This type of fence can not be recommended for use on the ordinary home lot, because of the space occupied. If it is used the suggested distance between plants is one foot. Under good conditions a fence should be established in two to three years.

CONCLUSIONS AND SUGGESTIONS FOR GROWING

Roses have been growing in the experimental plots at L. S. U. for 16 years. These tests have definitely shown that many excellent varieties of roses can be successfully grown in south Louisiana. Some varieties have done better than others. Plants can not be judged by one period of bloom; flower production and growth over several seasons should be considered. Many people are still likely to be disappointed with roses in their own yards because they may not be able to meet all the requirements necessary for excellent rose production or because some have been neglected. It isn't likely that anyone will do everything that should be done or do it always at the right time, but the more nearly it is done, the more likely the successful growing of roses will be accomplished. For emphasis, the following points, important for best success with roses, are stated again though they have been discussed in this bulletin:

1. Be sure that the rose bed has good drainage.
2. Have exposure to full sun if possible.
3. Prepare the soil well in advance of planting.
4. Get the best plants obtainable.
5. Plant varieties that are adapted to the area.
6. Set the plants at proper time of year and when the soil is not muddy.
7. Let the plants become well established before cutting blooms. Do not overcut.
8. Disbud when side buds are small.
9. Do not apply too much fertilizer.
10. Decomposed organic matter is beneficial.
11. Prune at proper times.
12. Irrigate thoroughly when necessary.

13. Control black spot and other diseases.
14. Control aphids, thrips and other insects.

The planting of roses should not be discouraged even though all qualifications can not be met. A rose garden that is only fair is far better than none at all.

E5D

LOUISIANA BULLETIN NO. 452 MAY, 1951

LIBRARY
NEW MEXICO STATE
UNIVERSITY

Grazing Values For Cattle On Pine Forest Ranges In Louisiana

By

ROBERT S. CAMPBELL AND JOHN T. CASSADY
Southern Forest Experiment Station, Forest Service
U. S. Department of Agriculture

SURPLUS
NMSU LIBRARY
LAS CRUCES

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

In Cooperation With
Southern Forest Experiment Station

CONTENTS

PAGE

Importance of Louisiana's Pine Forest Range 5

The Forage on Forest Range 6

Seasonal forage growth and value 7

Components of cattle diet 11

Important forage plants in Louisiana piney woods 15

Grazing on burned range 15

Beef Cattle Production on Forest Range 18

Cattle gains and losses 18

Herd productivity and nutritional level 22

Most Profitable Forest Range Use Requires Improved Management 24

Improved forest range management 24

Improved livestock management 27

Summary 29

Literature Cited 31

GRAZING VALUES FOR CATTLE ON PINE FOREST RANGES IN LOUISIANA [1]

By ROBERT S. CAMPBELL and JOHN T. CASSADY[2]

IMPORTANCE OF LOUISIANA'S PINE FOREST RANGE

Louisiana has a vast grazing resource in the native grasses, weeds and shrubs that grow in its piney woods. This pine forest area covers 10 million acres, or one-third of the state. Much of it has relatively open stands of trees, and yields an average of about one-half ton of grass per acre, in addition to its major product—timber. Nearly half of the 1,332,000 cattle in Louisiana graze on forest range for at least a part of the year. Thousands of farmers, owning from one to several hundred cattle, benefit by this forage.

Forest range forage in Louisiana is nutritious mainly in spring and early summer, and of low quality in fall and winter. However, cattle are commonly grazed on the range yearlong, and consequently suffer severe losses in weight and thriftiness during fall and winter. Because much of the area is unfenced "free range," it is difficult to give proper care to either the range or the livestock. Calf crops average only about 50 per cent and calves seldom weigh more than about 300 pounds in the fall. Death losses average from 4 to 6 per cent. Thus, beef production from cattle on forest range is only about half of what it can be under improved management.

There is real opportunity to increase range cattle production and income in Louisiana by making more effective use of the low-cost native forage on forest lands. This means recognizing the values of the native forage—and even more important, its limitations.

Until recent years, there was little available information on range grazing values and improved management of forest range in the South. To obtain this information for Louisiana conditions, a study of forest grazing values in the State was made from 1944 to

---

[1] Investigations conducted by the Forest Service, United States Department of Agriculture, in cooperation with the Louisiana Agricultural Experiment Station.

[2] Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.

1949 by the Southern Forest Experiment Station in coordination with the Louisiana Agricultural Experiment Station.[3]

This report describes results of the study, including the kind, amount, and nutritive value of forage on pine uplands in Louisiana. Furthermore, it shows how weight gains and losses of range cattle are related to these forage values, and how cattle owners can use the forest range most effectively in cooperation with good farm and forest management.

THE FORAGE ON FOREST RANGE

For the first few days in early spring when green forage is scarce, cattle show very little preference in grazing the fresh new growth on many different kinds of grasses and weeds. As the season advances, however, they choose those plants that have the highest grazing value. They prefer rapidly growing grasses; they try to avoid plants that, although still green, have stopped growing and have lost succulence and nutritive value. This preference partly accounts for the "patch grazing" noted on most ranges: the animals keep coming back to favored spots to nip off the grass regrowth.

Studies of grazing values on longleaf pine forest lands were conducted in central Louisiana in 1945, 1946, and 1947, on fenced pine plantations used as experimental forest ranges. Cattle grazing these experimental ranges were observed closely to determine the kinds and amounts of plants they ate each month of the year. Chemical analyses were made of composite samples of the same kinds of plants as were eaten by the cattle. The amount of grass produced each month was measured on plots in open areas and wooded areas, on burned and on unburned ranges. A four-year study was made of seasonal forage growth on one of the experimental forest ranges from 1944 to 1947. In 1946, a supplemental survey was made of forage production and use in different upland forest types and in different parts of the state. All these studies gave information of considerable value in managing range cattle. The findings will be summarized under the following topics: (1) Seasonal forage growth and value, (2) cattle diet on experimental ranges, (3) important forage plants in Louisiana piney woods, and (4) grazing on burned range.

---

[3] Cattle were weighed under supervision of the late Dr. C. I. Bray and C. B. Singletary of the Department of Animal Husbandry Research; and chemical analyses of forage samples were made by E. A. Epps, Jr., chief chemist, C. C. Moreland, J. L. Farr, and Miss Frances Bonner of the Fertilizer and Feedstuffs Laboratory of the Louisiana Agricultural Experiment Station. The cattle were owned by the Bankston-Donaldson Stock Farm, Dry Prong, Louisiana. Weekly cattle diet observations in 1945 were made by V. L. Cory.

Seasonal Forage Growth and Value

The amount of forage and its nutritive value are essential in determining both grazing capacity and the best season to graze forest ranges. Early spring growth is especially important because it comes when range cattle are in poorest condition; if cold weather delays spring growth even by two or three weeks, the result is extra expense for supplemental feeding or increased death losses. After growth is well started, the rate and total yield depend largely upon the amount and distribution of rainfall, according to indications from the four-year study of seasonal forage growth in central Louisiana. In 1944, growth started rapidly in early March, but because July and October were very dry, total grass growth for the year was only 1,722 pounds per acre (air dry). In 1945, on the other hand, growth started late because of a cold March, but thereafter rainfall was ample and well distributed, and grass weight continued to increase from 322 pounds per acre in April to a total of 2,537 pounds in October. Total grass growth for 1946 and 1947 was between these extremes.

More important than total grass production is the stage of growth and the nutritive value when it is grazed. Chemical analyses of forage samples show that the cow is right in choosing young green grass growth. The nutritive values of grasses are high when leaves are young, and then decrease as the leaves mature. This is illustrated in Table 1, which shows the crude protein, calcium, and phosphorus content of three important range grasses in early leaf, full leaf, and in mature green leaf. Beef breeding animals need about 8 to 9 per cent crude protein (moisture-free basis) in a roughage to maintain body health (2,9).[4] A calcium content of 0.20 to 0.25 per cent for nursing cows and most growing animals is considered adequate for proper bone structure and good body growth. Of phosphorus, the nursing or pregnant cows and young animals need from 0.18 to 0.21 per cent in their feed for proper development of bones, blood, body tissues, and milk for cows with calves.

---

[4] Numbers in parentheses refer to Literature Cited, page 31.

TABLE 1.—Nutritive values of three predominant range forage grasses at different stages of development, central Louisiana, 1945 and 1946

Species and stage	Crude protein		Calcium		Phosphorus	
	1945	1946	1945	1946	1945	1946
	– Percent –					
Pinehill bluestem						
Early leaf	8.91	12.92	0.18	0.24	0.13	0.17
Full leaf	7.48	7.06	.23	.25	.08	.09
Mature (green)	5.24	5.29	.24	.31	.06	.07
Slender bluestem						
Early leaf	9.56	13.29	.18	.34	.07	.19
Full leaf	7.55	8.30	.27	.27	.07	.10
Mature (green)	3.48	(1)	.20	(1)	.04	(1)
Panic grasses						
Early leaf	16.33	13.38	.14	.26	.15	.17
Full leaf	12.70	(1)	.24	(1)	.13	(1)
Mature (green)	8.68	6.13	.35	.21	.10	.07

(1) No samples taken.

Fresh young leaves of some grasses contain from 9 to 16 per cent crude protein, ample for cattle to make good weight gains. The fully-grown but still fairly succulent leaves generally contain from 7 to 8 per cent protein; this is sufficient to maintain cattle weights. The mature green plants usually have only 5 to 6 per cent protein, not enough to keep up cattle weights. The rapidly growing flower stalks of mature plants, however, usually have a satisfactory protein content of 8 to 9 per cent.

Phosphorus, like protein, is highest in the fresh young grass, and decreases in the older leaves. However, phosphorus at its best was not quite adequate for beef breeding animals in any of the three grasses.

Calcium was lowest in the early leaf stage, and below breeding herd requirements at that time. While calcium content was adequate in the full leaf and mature leaf stages, older leaves are eaten much less readily than young ones.

At times, some green weeds have a consistently higher protein content than grasses. In 1946, leaves of several range weeds, including lespedeza, tick trefoil, and sunflower, had protein contents of 9 to 10 per cent or more in May and June when most grasses had reached full leaf stage, with less than 8 per cent protein. Likewise there is a reason why cattle turn to certain shrubby plants in winter. For example, samples of waxmyrtle leaves and twigs picked in January or February of 1945, 1947, and 1949 contained 9.5 to 10.5 per

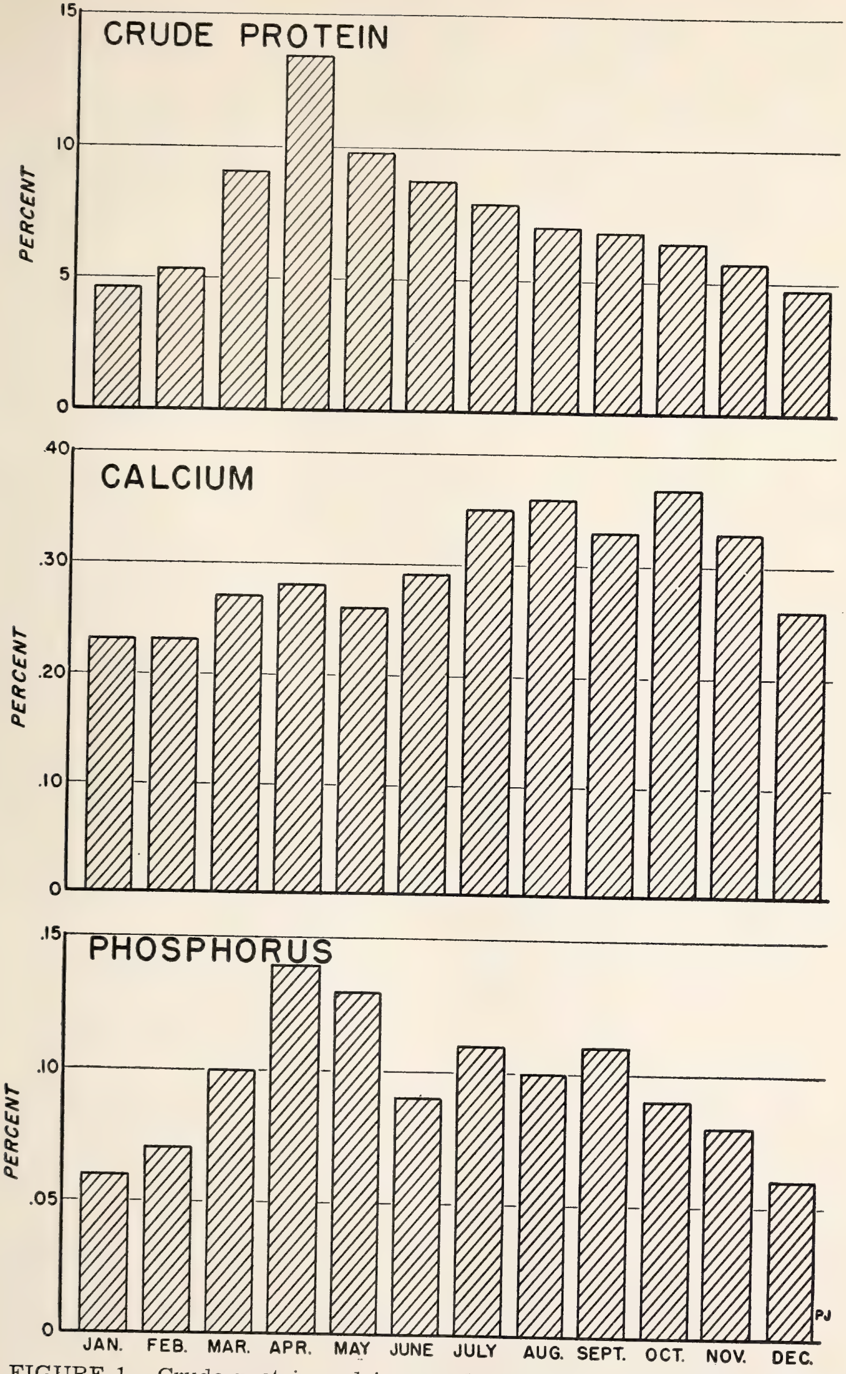


FIGURE 1. Crude protein, calcium, and phosphorus content of cattle diet on experimental forest ranges in central Louisiana, 1945-1947 inclusive (moisture-free basis).

cent protein. By contrast, dry grass has only 2 per cent and the green grass that grows in winter has less than 5 per cent protein.

The nutritive values of all the range herbage grazed during various seasons are even more significant in cattle diet than the individual species. Figure 1 shows the average crude protein, calcium, and phosphorus contents of monthly composite forage samples of cattle diet on the experimental forest ranges for the three years 1945-1947.

Crude protein was more than ample in April, adequate in March, May, and June --- a total of 3½ to 4 months of good grazing. Beginning in July, the average protein content gradually declined to a low of 4.61 in December. For breeding animals, it was inadequate from July through February. In one year, 1946, the diet selected by cattle in September included many fast-growing flowerstalks of bluestem grasses, and thus had a protein content of over 8 per cent. However, if Indian summer happens to be hot and dry, the protein in forage remains around 5 or 6 per cent. Dry cows apparently can maintain body weight with about 7 per cent crude protein in their forage. For these animals the protein content of forest range forage was adequate for nearly 7 months, from March through September.

Calcium content of range forage samples in central Louisiana appeared satisfactory throughout the year, with a barely adequate low of 0.22 per cent in December and a high of 0.36 in July (Figure 1). However, many of the pinehill soils are low in calcium and this is reflected in the forage (10).

Average phosphorus content of range forage was not adequate at any time of the year (Figure 1). Even the April level of 0.14 per cent was below the minimum of 0.18 per cent for beef breeding herds. Phosphorus content was higher in the summer months than in winter; it fell to 0.06 per cent in December and January.

As will be described later, these chemical analyses emphasize the need for supplements of one or more kinds during most of the year.

Nutritive Values in Different Types.-- It is commonly said that grasses growing in a pine or hardwood forest do not have as much "strength" as those on open or untimbered range. To test this idea, forage samples of bluestem grasses were collected for chemical analysis periodically throughout 1945 in the open grass, longleaf pine, and scrub oak types.

The percentages of protein, calcium, and phosphorus through the year were very similar to those for the cattle diet samples shown in Figure 1. Average protein values in March were 15 per cent and more, but the content for all three types dropped below 5 per cent by November. The small differences in nutritive value of forage in different forest types were inconsistent and are not important in animal nutrition.

Components of Cattle Diet

In central Louisiana, grasses and grasslike plants are by far the most abundant kinds of range plants; they made up about 95 per cent of the cattle diet on the experimental forest ranges studied in 1945 and 1946. Weeds (broadleaved herbs or forbs) made up about 4 per cent and browse 1 per cent of the yearlong diet.

The way in which cattle shift from one plant to another in order to graze the tenderest leaves and most nutritive forage from month

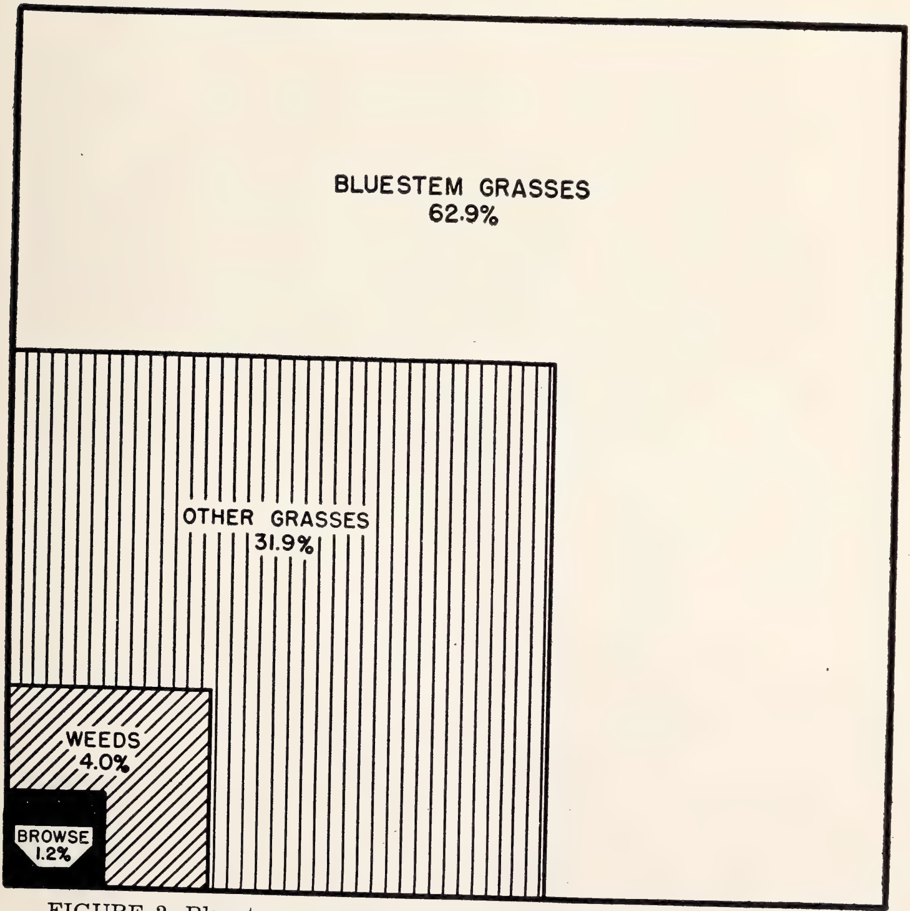


FIGURE 2. Bluestem grasses made up nearly two-thirds of the average yearlong cattle diet on experimental forest ranges in central Louisiana in 1945-1946.

to month is indicated by the average cattle diet for 1945 and 1946 (Table 2). The great importance of bluestem grasses is shown in Figure 2); they produced nearly two-thirds of the yearlong forage grazed by the experimental cattle on pine forest range in central Louisiana. Two factors account for this: bluestems made up over half of the herbaceous vegetation; and, compared to most other grasses, they consistently had a high forage value (9 to 13 per cent crude protein) in early spring.

There are two groups of bluestems--the larger, coarse-leaved species and the smaller, fine-leaved kinds. During the study of cattle diet in central Louisiana in 1945 and 1946, coarse-leaved bluestems furnished one-third of the cattle diet in winter, over half in June, and between 40 and 50 per cent in summer and fall. They contributed just over 40 per cent of the diet on a yearlong average. Included in this group is pinehill bluestem, the most abundant and the most valuable forage plant in Louisiana's piney woods. This species, along with other important grasses, is illustrated in Figure 3.

The fine-leaved bluestems ranked second in importance and furnished one-fifth of the yearlong forage supply. The main species here is slender bluestem (Figure 3).

Other grasses contributed to the cattle diet at particular seasons of the year (Table 2). Woolly panicum (Figure 3) and similar small upland panicums began growth in late winter and grew rapidly in March when other grasses were just starting. These panicums were eaten eagerly in this early leaf stage, and furnished up to 16 per cent of the cattle diet on the experimental range in March. They produced seed heads starting in May, matured early, and were grazed very little in summer, fall, or winter. The summer and fall growth of narrow upright leaves is tough and was seldom grazed.

Carpetgrass, when available, furnishes palatable forage in summer after other grasses begin to mature. Experimental cattle kept it grazed closely, and new leaves with 8 to 10 per cent protein continued to develop. However, there is not enough carpetgrass on typical forest ranges to keep cows gaining in summer.

The paspalums, of which Dallis grass is a cultivated species, furnished 5 to 6 per cent of the yearlong forage. They usually provide fairly even grazing throughout the year, because one kind is preferred in spring and summer and another is grazed mostly in fall and winter.

TABLE 2.—Average cattle diet on experimental forest range in central Louisiana, 1945-46

Species	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
	Percent												
Coarse-leaved bluestems	35	38	32	40	51	52	41	50	38	46	42	38	42
Fine-leaved bluestems	13	20	20	18	23	26	31	22	17	13	28	20	21
Carpetgrass	5	4	2	2	1	1	4	6	7	3	5	4	4
Dropseed	7	8	8	4	9	5	4	3	3	2	1	4	5
Muhly	10	7	2	3	T[1]	T	0	0	0	1	1	4	2
Panicums	1	6	16	12	6	2	1	1	5	6	1	4	5
Paspalums	9	5	3	4	1	2	7	7	8	6	6	7	5
Miscellaneous grasses	10	3	6	6	2	4	5	5	10	11	12	9	7
All grasses	90	91	89	89	93	92	93	94	88	88	96	90	91
Grasslike plants	5	6	4	5	4	2	3	3	4	2	2	6	4
Weeds	1	T	4	6	3	6	4	3	7	10	2	2	4
Browse	4	3	3	T	0	T	0	0	1	0	T	2	1
Total	100	100	100	100	100	100	100	100	100	100	100	100	100

[1]-T = trace.

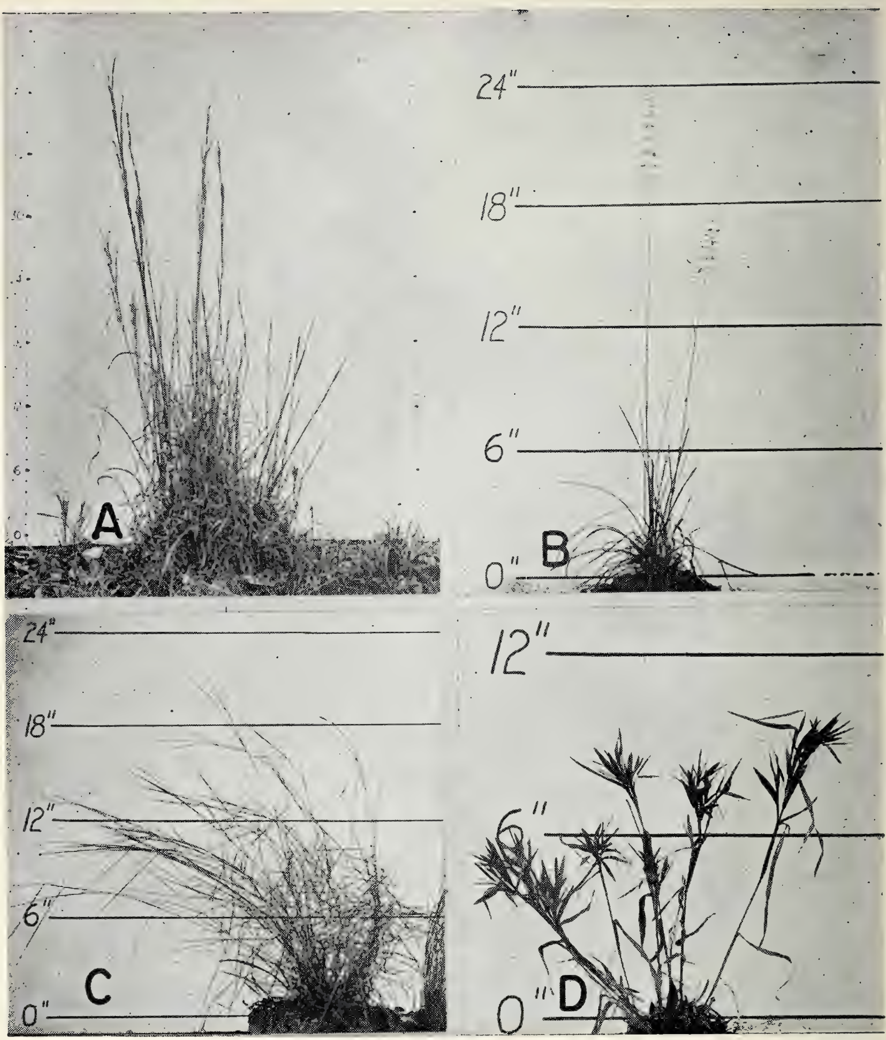


FIGURE 3. Important forage grasses of the pineywoods. -- A. Pinehill bluestem. --B. Blue dropseed. -- C. Slender bluestem. -- D. Woolly panicum.

Blue dropseed was grazed yearlong and contributed nearly 5 per cent of the forage even though it was not abundant on the experimental forest ranges (Figure 3). It was grazed most heavily in winter and spring. Muhly was used only in winter, when its long, wiry leaves were greener than those of most grasses.

All together, grasses made up 91 per cent of the yearlong forage grazed by cattle on the experimental forest ranges in 1945 and 1946.

The amount of grasses consumed varied from 88 to 96 per cent of the diet in different months, as shown in Table 2.

The grasslike sedges and beakrushes averaged 4 per cent of the yearly cattle diet but made up as much as 6 per cent in winter and spring, when they were relatively green and succulent.

Several succulent weeds supplement the grass forage during limited periods. However, because grasses were much more abundant and were usually preferred by cattle, weeds furnished only 3 to 10 per cent of the cattle diet during spring, summer, and fall on the experimental forest ranges. Weeds averaged 4 per cent of the yearlong cattle diet shown in Figure 2.

Cattle that graze on pine forest range in winter find slim pickings. They like to graze such browse as elliott blueberry, waxmyrtle, and dwarf sumac, which have relatively high crude protein contents at this season. Palatable browse plants, however, are scarce on most ranges. On the ranges studied in central Louisiana, browse made up only 4 per cent of the cattle diet during winter; grasses still comprised 90 per cent during that season.

Important Forage Plants In Louisiana Piney Woods

The number of important forage plants in the Louisiana piney woods is not great. Table 4, Page 16, lists 20 grasses, 2 grasslike plants, 4 weeds, and 3 shrubs which make up the bulk of the native range forage. The notes in the table on distribution, abundance, and forage value by seasons are based on all the information previously presented, including the observations of actual cattle grazing and chemical analyses of forage samples. It was checked in various types and parts of the state during the 1946 forage survey and also reflects general observations and experience on Louisiana forest ranges from 1944 to 1949.

The important plants, and their main differences in seasonal growth and grazing value, may be learned rather readily by any close observer.

Grazing On Burned Range

Cattle graze burned areas much more closely than adjacent unburned roughs. In 1945, part of one experimental forest range in central Louisiana was prescribe-burned (as defined on Page 26) to control brown-spot needle disease on planted longleaf pine seedlings. Cattle grazed 40 to 50 per cent of grass production on the burned range throughout the spring and summer, but unburned range in the same pasture was grazed only lightly up to July, and was practi-

TABLE 4.—The principal forage plants on piney woo

Plant names		Distribution in the pin
Grasses and grasslike plants		
Pinehill bluestem	**(Andropogon divergens)**	On all except wet places
Slender bluestem	**(A. tener)**	On all except wet places
Broomsedge bluestem	**(A. virginicus)**	On all except wet places (especi
Elliott bluestem	**(A. elliottii)**	On all except wet places
Paintbrush bluestem	**(A. ternarius)**	On all except wet places
Little bluestem	**(A. scoparius)**	On all except wet places
Fineleaf bluestem	**(A. Subtenuis)**	Scrub oak ridges, dry sites
Carpetgrass	**(Axonopus affinis)**	Trails, old fields, closely graze
Panic grasses	**(Panicum spp.)**	All sites
Blue paspalum	**(Paspalum plicatulum)**	Roadsides, old roads, swales
Dallis grass	**(P. dilatatum)**	Cultivated pastures, old fields
Florida paspalum	**(P. floridanum)**	On all except wet places
Blue dropseed	**(Sporobolus junceus)**	On all except wet places
Cutover muhly	**(Muhlenbergia expansa)**	Swales, flatwoods
Green silkyscale	**(Anthaenantia villosa)**	On all except wet places
Giant cane	**(Arundinaria gigantea)**	Creek bottoms, protected wet
Arrowfeather threeawn	**(Aristida purpurascens)**	Flatwoods and all except wet pl
Purple lovegrass	**(Eragrostis spectabilis)**	Woods except wet areas
Spike uniola	**(Uniola laxa)**	Heavily forested creek bottoms
Switchgrass	**(Panicum virgatum)**	Moist sites
Beakrush	**(Rhynchospora globularis var. recognita)**	All sites, especially moist, poorly
Knotleaf rush	**(Juncus validus)**	All sites, especially moist, poorly
Weeds		
Swamp sunflower	**(Helianthus angustifolius)**	On all except wet places
Littleleaf tickclover	**(Desmodium ciliare)**	On all except wet places
Common lespedeza	**(Lespedeza striata)**	Pastures, fertilized areas, trails
Grassleaf goldaster	**(Chrysopsis graminifolia)**	On all except wet places
Shrubs or browse		
Southern waxmyrtle	**(Myrica cerifera)**	On all forested areas
Elliott blueberry	**(Vaccinium elliottii)**	Forested areas, acid soils
Shining sumac	**(Rhus copallina)**	On all except wet places

[1] **Sites**

Wet places:	Stream banks, swamps, places wet or flooded most of the year.
Moist places:	Flooded during rainy spells; seldom dry even in hot dry seasons: swales, crawfish land.
Dry sites:	Well drained ridges, slopes, hills and areas that dry quickly.

[2] **General abundance**

Very abundant:	Widely distributed species, each of which makes up from 10 to 30 per cent of the ground vegetation.
Abundant:	Widely distributed plants that make up from 3 to 10 per cent of ground cover.
Common:	Plants that can be found on most areas, but do not usually constitute more than 1 to 5 per cent of ground cover.
Scattering:	Plants that are often hard to find are usually restricted in distribution, and make up very little of the ground cover.

ranges of Louisiana in approximate order of importance

voods[1]	General abundance[2]	Forage value by seasons[3], [4]			
		Spring	Summer	Indian summer	Fall-winter
	Very abundant	Very good	Fair	Fair to good	Poor
	Very abundant	Very good	Fair	Fair to good	Poor
on old fields)	Abundant	Very good	Fair	Fair to good	Poor
	Abundant	Very good	Fair	Fair to good	Poor
	Abundant	Very good	Fair	Fair to good	Poor
	Scattering	Very good	Fair	Fair to good	Poor
	Scattering	Very good	Fair	Fair to good	Fair to poor
pots, swales	Common	Excellent	Good	Good	Fair
	Very abundant	Good	Poor	Poor	Poor
	Common	Good	Fair	Fair to good	Poor
	Scattering	Excellent	Good	Very good	Poor
	Common	Good	Fair	Poor	Not grazed
	Common	Very good	Fair	Fair to good	Fair
	Common	Fair	Poor	Fair to poor	Fair
	Scattering	Fair	Fair	Good	Fair
es	Scattering	Very good	Good	Good	Good
s	Abundant	Good	Poor	Poor	Poor
	Common	Good	Poor	Poor	Poor
	Common	Good	Fair	Good	Poor
	Common	Very good	Fair	Poor	Poor
ained places	Abundant	Good	Poor	Poor	Fair
ained places	Common	Good	Poor	Poor	Fair
	Abundant	Good	Good	Good	Poor
	Common	Good	Good	Good	Not grazed
	Scattering	Short growth	Very good	Very good	Frost-killed
	Common	Good	Poor	Poor	Not grazed
	Common	Not grazed	Not grazed	Not grazed	Fair
	Scattering	Not grazed	Not grazed	Not grazed	Fair to good
	Common	Not grazed	Not grazed	Not grazed	Fair to good

[3] **Approximate duration of seasons**

Spring:	March 16 to June 21.
Summer:	June 22 to August 31.
Indian-summer:	September 1 to October 15 (dependent on good rainfall in late summer).
Fall-winter:	October 16 to March 15.

[4] **Quality of forage**

Excellent:	Nutritive value sufficient for rapid growth and weight gains by all classes of healthy cattle.
Very good:	Nutritive value sufficient for good weight gains by all classes of healthy cattle.
Good:	Nutritive value sufficient for small weight gains by all classes of healthy cattle.
Fair:	Nutritive value barely sufficient to maintain weights of growing animals; cows lose weight.
Poor:	Herbage constitutes roughage only and animals lose weight rapidly unless better feed is provided.
Not grazed:	Not grazed because of dormancy, unpalatable condition, or better forage available.

cally ungrazed thereafter. When part of the area protected from fire in 1945 was prescribe-burned in March 1946, the cattle immediately started grazing the fresh burn.

The outstanding fact about burning was that it removed old grass growth so that cattle could graze solely on new green grass of high nutrient value. The animals spent about 90 per cent of their time on the burned areas early in the spring because growth started earlier and there was no old dry rough to interfere with eating. This close grazing reduced the amount of grass produced on the burned areas to about one-third less than on unburned areas (4). On ungrazed check plots the burned portion produced as much grass as the unburned.

Burning did not significantly increase the nutritive content of green grass (Table 3). Crude protein, calcium, and phosphorus were considerably higher on burned than on unburned areas in January, but all values were far below breeding herd requirements at that time. At all other seasons, the differences between burned and unburned areas were mostly small and inconsistent. The seasonal rise and fall of these nutrients on both burned and unburned range is much greater and far more important in animal nutrition.

Although prescribed burning, when correctly applied, will improve grazing conditions, wildfires or indiscriminate burning will cause severe damage to the forest stand, to the soil, to wildlife, and even to the forage. Brief precautions in the use of fire will be indicated later.

TABLE 3. Nutritive values of forage from burned and unburned ranges in 1945 (averages from 3 types: open-grass, oak-grass, and pine-grass)[1]

Month	Crude protein		Phosphorus		Calcium	
	Burned	Unburned	Burned	Unburned	Burned	Unburned
	Percent					
January	6.85	4.45	0.08	0.05	0.24	0.14
March	15.54	16.21	.26	.26	.27	.29
May	8.83	8.63	.11	.12	.32	.29
July	6.30	6.03	.08	.09	.25	.22
September	5.35	4.87	.08	.07	.24	.27
November	4.10	4.06	.06	.05	.24	.20

[1] Burned area was prescribe-burned in early January 1945.

BEEF CATTLE PRODUCTION ON FOREST RANGE

Cattle Gains and Losses

The weight gains and losses by cattle that graze yearlong on forest range give the most critical test of the seasonal nutritive value of native forage. In order to get a record of such weight changes, a herd of about 80 grade cows, together with their offspring, was studied from October 1945 to March 1948. The herd contained a mixture of grade Hereford, grade Aberdeen Angus, and common or native beef cows. Some individuals were of high grade and some very common, but most were average Louisiana range beef cattle. One Aberdeen Angus and three Hereford bulls were kept with the herd yearlong. The bulls were not given any special feed or pasturage and they usually lost considerable weight in winter. It is probable that a carotene deficiency during winter reduced the breeding ability of the bulls (9).

The cattle were run on a fenced experimental range near Dry Prong, in central Louisiana. All cattle were weighed every 4 to 8 weeks, and special efforts were made to get weights at the end of each season. The average seasonal weight gains or losses of cows, yearlings, and calves for 1946, 1947, and 1948 are shown in Figure 4 for three main seasons -- spring, summer, and fall-winter. The cattle made substantial weight gains during spring, held their weight or lost a little during summer, and lost severely during fall and winter.

The Spring Season. --- All cattle --- cows, calves, and yearlings --- gained weight during the spring season of 103 days from March 15 to June 25. This is a period of abundant moisture, mild temperatures, rapid plant growth, and relatively high nutritive values in forage. Average weight gains per head per day were 1.5 pounds for calves, 1.3 pounds for yearlings, and 0 8 pound for mature cows. The gains by cows were made despite losses in weight when calves were dropped — and most of the calves were born in spring.

The most thrifty calves and yearlings made gains of two to three pounds per day during April and May, when forage was both abundant and highly nutritious. Gains gradually diminished during the last 30 or 40 days of the spring season as the grass lost its freshness.

Such spring weight gains are high enough to warrant use of forest range by cattlemen wherever such range is available under reasonably good control and management.

The Summer Season—During the summer period of 3½ months from late June to early October, cattle just about held their own by grazing on forest range. Calves made slow gains. Yearlings gained slowly in some years and lost during others. Mature cows lost weight.

In some years, the summer is broken into two shorter seasons--- midsummer and Indian summer. Cattle lose weight in July and August when temperatures are high, rainfall is spotty, and grass

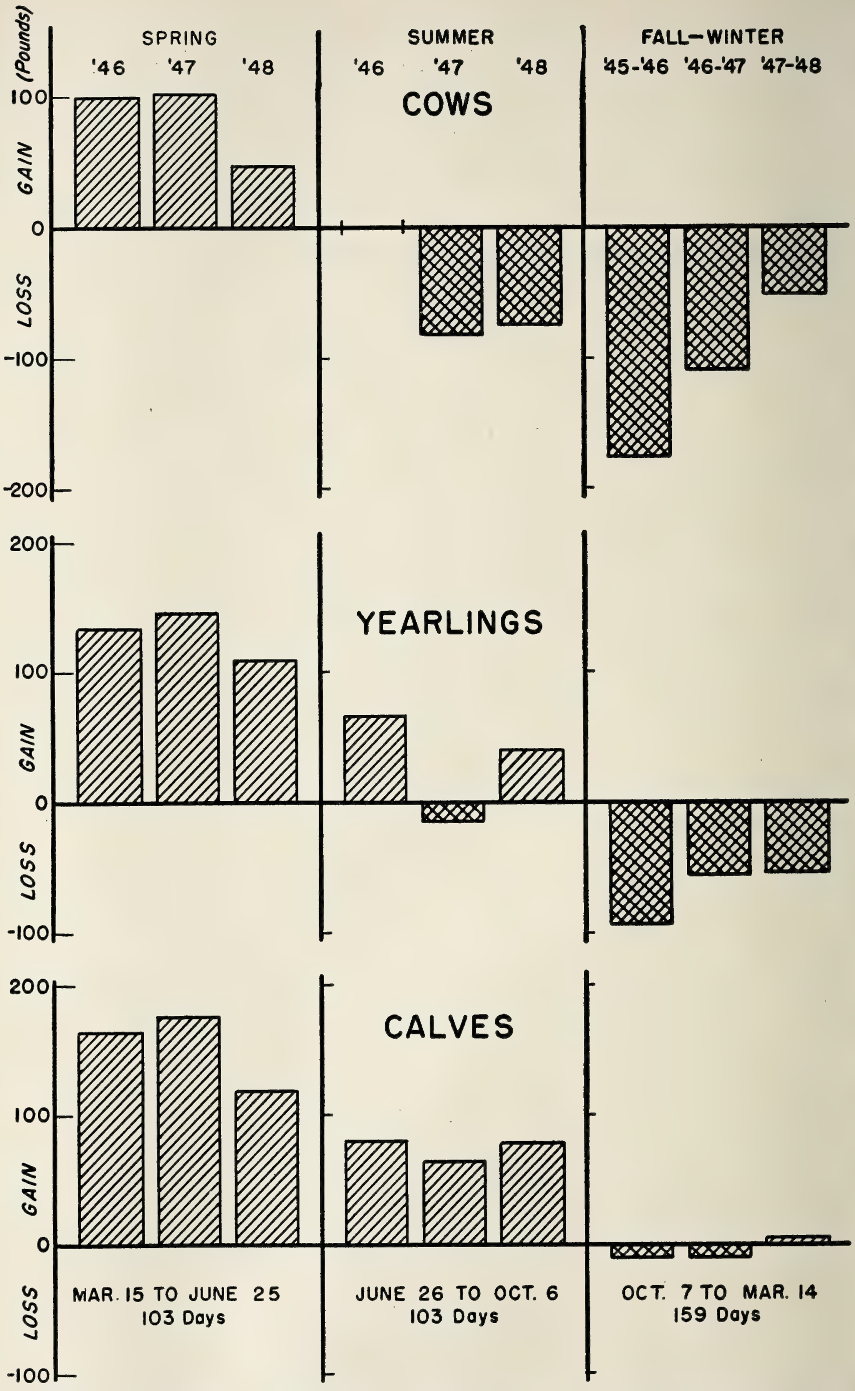


FIGURE 4. Seasonal weight gains and losses by beef cattle grazing forest range in central Louisiana, 1945-1948.

practically stops growing. But if weather conditions are favorable, Indian summer---September mainly---may be a season of fairly good gains. For instance, all animals gained in September 1946; but in 1947 and 1948 dry weather and poor forage growth caused all animals except calves to lose weight right on through September.

Native forage alone is not good enough during July and August for the most profitable livestock production. Calves do gain some weight --- in 1946, 1947, and 1948 the experimental calves gained an average of 74 pounds apiece during the 103 days of summer. But they ended up weighing only 310 pounds in October. The same calves on good pasture throughout the summer would have weighed 400 pounds or more by early October. Also, the breeding cows that lose weight during summer are not in good condition for the fall-winter period, especially if they are to be kept on forest range during these cold months. Therefore, it appears that improved pastures are desirable for summer grazing. However, when no better forage is available, forest range may be used to help maintain the herd at a low cost during parts of the summer.

The Fall-Winter Season—The real losing period for cattle on forest range is fall and winter, the 5 months from early October until mid-March. Poor forage and occasional cold weather team up to knock the weight from cattle of all ages. In the winter of 1945-46, the cows lost an average of 176 pounds, nearly 25 per cent of their weight, in 141 days. They received a very small ration of cottonseed meal during the winter.

During the next two winters, the cattle were fed a substantial ration of cottonseed meal for about 85 days in January, February, and March. The ration averaged 190 pounds of cottonseed meal per animal unit in 1947 and 230 pounds in 1948. The cattle lost weight heavily in fall each year before supplemental feeding started. After feeding was begun, however, they lost only 24 more pounds in 1947 and gained 36 pounds per head in 1948. Thus the heavy fall losses in weight were moderated somewhat by the supplemental feeding that followed; this accounts for the smaller net losses during the last two fall-winter periods (see Figure 4).

Nevertheless, even after eating $8.00 to $12.00 worth of supplemental feed per head, the cattle ended each winter in only fair condition. The chief cause was the heavy weight loss in fall before feeding started. This raises a major question in forest range management. What use, if any, can be made of forest range during fall and winter, from October to late March? This study proved conclusively that pine forest range is of such low quality in fall and winter that it needs to be heavily supplemented to keep the beef herd in productive condition (Figure 5). It seems likely that some combination of native forage, cultivated pastures, and protein concentrate may prove most economical for wintering beef cattle satisfactorily.

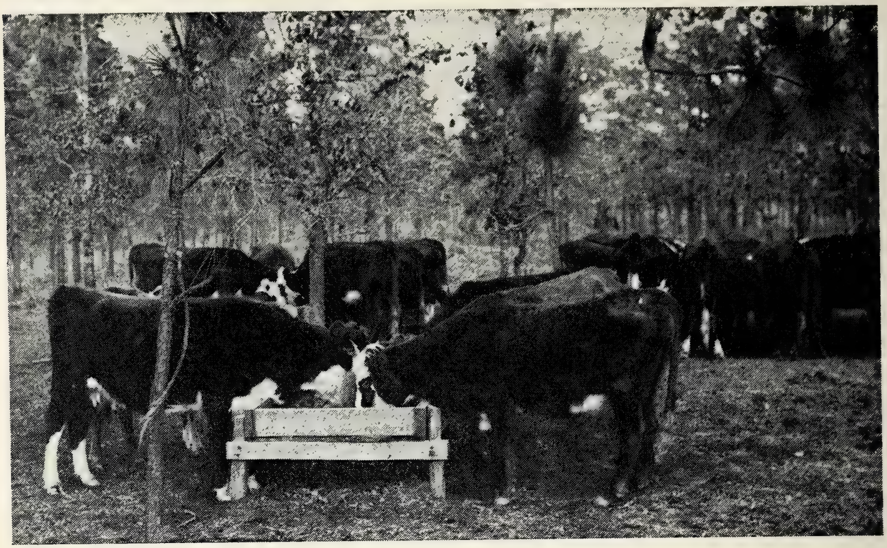


FIGURE 5. Cattle that graze forest range in winter need a good protein supplement. Two pounds of cottonseed cake per head each day during the three winter months kept this herd from having serious losses.

Herd Productivity and Nutritional Level

Range cattle in Louisiana today average 50 per cent calf crops, 300-pound calves in the fall, and about 5 per cent death losses. With good herd management and adequate nutrition, the calf crops can be raised to 75 per cent or more, calf weights increased to at least 350 pounds, and death losses reduced to 2 per cent or less. The rewards of adequate yearlong forage and feed for range cattle are plainly shown in Table 5, which compares calf crops, calf weights, death losses, and beef production for herds with good and poor yearlong nutrition on open longleaf pine ranges in Louisiana during 1943 (4).

The first two herds in Table 5 were well managed and well fed. They had adequate range, pasture, or supplemental feed throughout the year. Both herds used fenced forest range in spring.

Except for the weak cows in one herd, the other two herds were carried on "free" unfenced forest range yearlong and received little or no supplemental feed in winter. For at least six fall and winter

TABLE 5.—Production of beef from herds receiving good yearlong feed and from herds not adequately fed

Type of operation	Seasonal feed supply				Calf crop	Calf weights	Death losses	Beef produced per cow[1]
	Spring	Summer	Fall	Winter				
	April-June	July-Sept.	Oct.-Dec.	Jan.-March				
					Percent	*Pounds*	*Percent*	*Pounds*
Good yearlong feed								
Farm and fenced national forest range	Fenced forest range	Fenced forest range	Improved pasture	Improved pasture, 100 days' supplement of 2 lbs. cottonseed meal and 4 lbs. hulls per head per day	78	355	2.0	263
Farm and leased fenced forest range	Fenced forest range	Improved farm pasture	Field gleanings and farm pasture	Farm pasture and winter oats grazing, 90 days with supplement of 1 lb. cottonseed meal, and 8 lbs. hay per head per day	74	350	3.0	238
Poor yearlong feed								
Farm and free forest range	Free forest range	Free forest range	Free forest range	Main herd on free forest range with no supplement. Weak cows on farm pasture and 1 lb. cottonseed meal and 2 lbs. hulls per head per day	37	275	5.7	68
Yearlong on free forest range	Free forest range	Free forest range	Free forest range	Free forest range, 60 days' supplement of ½ lb. cottonseed meal and 2 lbs. hay per head	35	300	6.4	67

[1] Beef production includes total weight of calves produced per cow less weight of cows that died. Cows in the well-fed herds averaged 700 pounds, those in the poorly fed herds 600 pounds in fall.

months of the year the animals in these herds struggled to get enough nutrients to keep alive.

The two well fed herds averaged 250 pounds of beef production per cow, while the two poorly fed herds averaged only 67.5 pounds of beef. The calf crops of the well fed herds were double those of the poorly fed ones, but the real payoff---beef produced per cow---was nearly four times as great.

It takes money to provide good nutrition and care such as illustrated in Table 5. However, each cow in the well fed herds produced an average of 180 pounds more beef --- worth about $40.00 --- than the cows in the poorly fed herds. After the extra feed and care were paid for, there remained nearly $20.00 greater profit per cow as a result of good nutrition and management.

The average range beef operation in Louisiana is about halfway between the two extremes shown in Table 5. According to studies in 1943, about 70 per cent of the yearlong herd nutrition comes from forest range (4). Beef production is just fair, but with careful planning and some additional labor and expense, it can gradually be raised to equal or exceed the production of the two herds that received good yearlong nutrition.

MOST PROFITABLE FOREST RANGE USE REQUIRES IMPROVED MANAGEMENT

The practical application of the studies reported in this bulletin will be to the best interest of Louisiana but will require widespread changes in present forage and range cattle management. These changes will take many forms, but will fall in two broad categories: (1) improved range management, and (2) improved livestock management.

Improved Forest Range Management

Only with fenced control of forest range can the cattle producer begin genuine improvement in range management. It is just good business to enter into an agreement for grazing rights on fenced range. Many progressive cattlemen in the piney woods have already done so. The next step is to initiate needed management practices, the most essential of which are indicated below.

Graze Range During Proper Season --- From the cattle weight gains and the chemical analyses of forage reported herein, it is clear that piney woods range in Louisiana provides adequate nutrition for productive breeding herds for only four to five months in spring and early summer. The range grazing season should start in late March or early April when there is sufficient new grass for cattle to obtain a fill easily. The good grazing season usually lasts until about mid-July.

Adoption of a four-month spring season of range use will have to come gradually in the piney woods territory as a whole. Nevertheless, most profitable range use dictates a shorter range season as a part of sound management. Suggestions for pastures and supplemental feeds for the balance of the year will be indicated later.

Graze Proper Numbers on the Range. --- The average amount of forage produced annually on a range, and the number of cattle it will safely graze, may be estimated approximately from Table 6, which is based on a study of grazing values on the six broad types of forest range throughout the Louisiana uplands in 1946. The table indicates, for example, that treeless cut-over areas require about one acre per cow-month, while average second-growth longleaf stands and scrub oak stands (with about 200 trees per acre) require approximately 2.5 acres per cow-month. The number of animals grazed will vary from year to year but these estimates are conservative enough to insure against a shortage of forage in dry years and to avoid excessive grazing damage to grass, soil, and pine trees.

Future changes in amount of forage on forest range should be anticipated, so that changes in numbers of cattle can be planned accordingly. When pine stands are opened up by cutting, the grass increases temporarily, but when cut-over areas grow up to young stands of natural or planted pine, the forage decreases rapidly as the tree crowns close (4). In other cases, low-value hardwoods may be poisoned to open up the stands (12).

TABLE 6.—Grazing types, with average grass production and estimated spring and summer grazing capacity, in pine forest areas of Louisiana

Forest grazing type	Grass production per acre	Grazing capacity
	Pounds	*Acres per cow-month*
Grassland	1500+	1.0
Open forest	1200	1.5
Longleaf pine	660	2.5
Scrub oak	680	2.5
Loblolly pine-hardwood	280	6.0
Creek bottom hardwoods	400	4.0

In order to take full advantage of potential grazing capacity, and to avoid damage to the range, it is important to secure fairly even distribution of grazing. The customary methods used to get better distribution are fencing, herding, and water development. Another effective method is to move salt and mineral boxes into lightly grazed areas. On some ranges it may be feasible to attain better distribution of cattle by running a prescribed burn over ungrazed or lightly grazed areas about each 3 to 5 years.

Protect Soil and Timber.---Protection of soil and timber goes hand in hand with wise range use. Overgrazing and trampling cause severe damage to soil and timber reproduction. This is especially liable to happen on farm woodlands or under other conditions where too many animals concentrate on a small area. Such damage may be largely prevented by grazing only during the active growing season of the main forage grasses, by carrying only the number of animals that the range will support without damage, by keeping the livestock well distributed over the range, and by reduced grazing on areas where trees are small and most susceptible to damage. On farm woodlands and other small tracts, it is sometimes necessary to reduce or temporarily eliminate all grazing where there is grazing damage to pine or hardwood reproduction. Such damage may be especially severe in winter.

In the protection of soil and timber on forest range, it is essential to control wildfires. Wildfires destroy the tree reproduction and may retard tree growth, cause log defect, consume humus, allow erosion to start, and destroy wildlife. Untimely burns may destroy winter rough, which many cattle owners need for their herds. Small burns result in heavy concentration of grazing. However, prescribed burning, when properly done on forest range, with welfare of the trees foremost, can be used to improve both timber growth and grazing (1). Prescribed burning is the application of fire to land under such conditions of weather, moisture, etc. as will accomplish a specific management purpose.

Prescribed burning has many uses as a tool in forest management in the longleaf-slash pine type of the Coastal Plain. Foresters may use it to prepare a seedbed for natural regeneration, to control brown-spot needle disease of longleaf, and to reduce accumulated rough as a safety measure against damaging wildfires. On forest ranges grazed by cattle, these prescribed burns can usually be fitted into the management of the forage and the livestock. Furthermore, there are cases where prescribed burning may be used on forest ranges to improve the grazing, provided the fire does not conflict with timber production. Prescribed burning may be used to reduce accumulated rough, particularly on ranges occupied by the wiregrass type of forage such as slender bluestem. As has been mentioned, prescribed burning is also useful in attracting cattle to little-used parts of a large range.

Wherever prescribed burning is contemplated, it is well to check with the nearest State or Federal forest official to be sure of local regulations regarding fire and for advice in making the burn.

Improved Livestock Management

Good cattle management requires attention to proper nutrition, breeding, and health, in addition to good range management. Adequate yearlong nutrition and care are required for maximum beef production, and only high grade animals can make the most return from such management.

Adequate Yearlong Nutrition.--- This bulletin shows why native range forage alone is not good enough during midsummer, fall, and winter for effective beef cattle production. A major decision faced by range cattle owners is whether to: (1) graze yearlong or most of the year on forest range and provide supplemental feeds as needed, or (2) graze 3 to 7 months in spring and summer on forest range and provide a combination of permanent and temporary pastures and supplemental protein feeds during the balance of the year. The decision will depend upon the range and farm resources of the individual cattle producer. A basic yearlong system used successfully in the piney woods is about as follows:

Spring --- late March through June. Graze main breeding herd on forest range. Let permanent improved pasture grow and make one or more good cuttings of hay.

Summer --- July to mid-September. Graze permanent improved pasture or summer pasture.

Fall --- Mid-September to Mid-November. Graze main herd on permanent improved pasture, with grazing on forest range if fall growth is good.

Winter --- Mid-November to late March. Graze selected animals on temporary winter pasture, keeping the rest of the herd on permanent improved pasture or forest range with needed supplemental protein feed.

Winter Feeds and Pastures. --- The first step in attaining adequate yearlong nutrition is to provide an adequate winter diet. This can be done in one or any combination of the following ways:

(a) Feed one to two pounds of cottonseed meal per cow per day and allow the herd to graze forest range for roughage (5, 8). There are two big disadvantages in using this system: Protein feeds are usually expensive, and cattle do more damage to small pines in winter than in spring and summer.

(b) Feed good quality legume hay or mixed hay, but keep cattle on range or permanent pasture (8).

Temporary winter pastures of rust-resistant oats, winter peas, or Kentucky 31 fescue are being used increasingly for grazing weaned calves and older animals being fattened for market. The investment in such pastures is high but gains are also high. In studies in Louisiana and Mississippi, weaned calves on good oats pasture gained 1.25 to 2 pounds per head daily throughout winter (11, 14).

Summer-Fall Pastures. --- Next to winter, summer and fall are the most critical periods for Louisiana range cattle. Both permanent improved pastures and summer pastures have a definite place in providing good summer-fall grazing.

Permanent pastures grow and make good grazing at about the same seasons as forest range --- good growth in spring, semi-dormant in summer, and renewed growth in fall. Grazing the cattle on forest range in spring frees the permanent pasture to grow and produce one or more cuttings of hay for use in winter.

Details of pasture development and management are beyond the scope of this publication. In general, a good grass-legume mixture is considered best for permanent improved pastures in the uplands of the Louisiana Coastal Plain. Dallis grass, Bermuda grass, and sometimes carpetgrass are recommended. White Dutch clover, hop clover, and lespedeza are the most frequently used legumes. Species recommended for summer pasture include lespedeza, lespedeza and Dallis grass mixture, Sudan grass, and kudzu. The details of land preparation, fertilizers, seed mixtures and seeding, costs, and management are given in "Pasture and Feed," Louisiana Agricultural Extension Service Circular 248 (10).

Regardless of type of pasture or feed, adequate nutrition calls for plenty of salt, minerals (7), and water yearlong.

Breeding and Health. --- Good herd management also includes improved breeding, disease prevention, and careful handling. Range beef cattle in Louisiana have been improved considerably since the fever tick was eradicated but much more improvement in grade is needed. An effective plan for grading up and cross breeding native cows (which are of predominantly English breeds) with Brahman stock has been worked out by the U. S. Bureau of Animal Industry and the Louisiana Agricultural Experiment Station (13). This system, the result of more than 25 years of research at Jeanerette, Louisiana, increased the average weight of calves at 6 months of age from just over 300 pounds to more than 400 pounds. Other useful herd management practices are described in Louisiana Agricultural Experiment Station publications by Bray and by Cobb (3, 6).

In addition to breeding up the herd with improved beef-type blood, it is good practice to cull the herd systematically and replace barren and old cows with thrifty selected heifers sired by good bulls.

The breeding season should be controlled so that the calves will be born as early in the year as feed resources permit.

Cattle must be protected against diseases and pests. Calves should receive blackleg vaccine before they are 4 months old. Immunization against anthrax is usually recommended only in areas where the disease is known to cause trouble Spraying the herd periodically with insecticides to control ticks, warbles, and flies and other insect pests is rapidly becoming an accepted livestock practice. Cattle often lose considerable weight during the warm season by fighting flies and from the feeding of parasitic insects. It is important also to make frequent checks to find and treat sick and injured animals and to handle cattle so as to prevent injury.

SUMMARY

Range grazing is highly important on the 10 million acres of Louisiana's upland pine forest land -- about one-third of the total area of the state. Yet under the prevailing "free range" custom, the management of both range and livestock is generally poor, and beef production and cash returns are low. One important cause of low production is that while native forage is good only in spring, many beef cattle graze the range yearlong. A better system of using this cheap forage, along with improved range management and livestock production, would mean much to thousands of farmer-stockmen. This publication describes the seasonal qualities and limitations of the forest range and shows how it may be used profitably. The report is based on a study of the kind, amount, and nutritive value of the forage and on grazing experiments carried out on fenced forest areas in central Louisiana.

The bluestem grasses are by far the most important range forage plants; they make up nearly two-thirds of the forage grazed by cattle. Other species that grow earlier and later than the bluestems lengthen the grazing season and give desirable variety in the cattle diet.

Chemical analyses of samples from the same range forage plants grazed by cattle showed a very good nutritive value in spring, with 9 to 15 per cent protein. This gradually decreased to about 7 per cent in summer, and 5 per cent or less in winter. Average phosphorus content was not adequate at any time of year, even at its high point of 0.14 per cent in spring. Calcium was adequate during the active grass growing season. The nutritive value of the forage did not differ greatly between open and timbered areas.

Nutritive value was not greatly affected by burning, but fire removed the rough of grass and weeds and made the fresh forage more easily available for grazing. Burning should be done only when and where the timber stand will benefit. Prescribed burning on forest lands should be done only under the supervision and advice of a forester.

A study of several range beef cattle operations showed that herds receiving adequate yearlong nutrition and good care produced 3 to 4 times as much beef per cow as poorly-managed and inadequately-nourished herds.

In areas where forest grazing is practicable, a wise combination of adequate forage and good range and livestock management yearlong is required to raise production and income from range cattle. Even though farms are small, most of them can be managed to produce more pasture and feed than at present. Forest range is best used for grazing in spring. Better pasture or feed should be used the rest of the year --- perhaps kudzu or Sudan grass pastures for summer; a mixture of carpetgrass, Dallis grass, and lespedeza for summer and fall; and oats or Kentucky 31 fescue for fall and winter grazing. Supplemental protein concentrate or hay is needed for any animals left on the range during fall and winter.

Cattle on forest range should be managed, not only to use the range forage during the best season, but also to protect soil and timber.

Today the average range beef cattle herd in Louisiana has 50 per cent calf crops, 300-pound calves, and 5 per cent death losses. Adequate yearlong nutrition can increase calf crops to around 75 per cent or more, bring calves to over 350 pounds by fall, and cut death losses for the entire herd to 2 per cent or less. Grade improvement and controlled breeding would add greatly to the benefits of good nourishment and good care.

LITERATURE CITED

1. BICKFORD, C. A., and CURRY, J. R., 1943
The use of fire in the protection of longleaf and slash pine forests. South. Forest Expt. Sta. Occas. Paper 105, 22 pp., illus. (Processed.)

2. BLACK, W. H., KNAPP, BRADFORD, Jr., and DOUGLAS, J. R., 1939. Nutritional requirements of beef and dual-purpose cattle. In Food and Life. Yearbook of Agriculture, 1939, U. S. Dept. Agr., 519-543, illus.

3. BRAY, C. I., 1933.
Beef cattle production in Louisiana. La. Agr. Expt. Sta. Bul. 244, 21 pp., illus.

4. CAMPBELL, R. S., and RHODES, R. R., 1944.
Forest grazing in relation to beef cattle production in Louisiana, La. Agr. Expt. Sta. Bul. 380, 43 pp., illus.

5. CASSADY, J. T., 1947.
The need for winter feed. Coastal Cattleman 13 (8): 7-8, illus.

6. COBB, W. T., 1941 (reprinted).
Beef cattle—herd management. La. Agr. Col. Ext. Cir. 226, 4 pp., illus.

7. ………………………, 1943 rev.
Minerals for Livestock, La. Agr. Col. Ext. Cir. 174, 7 pp., illus.

8. COBB, W. T., and GAYDEN, H. L., 1941 (reprinted).
Wintering Beef cattle. La. Agr. Col. Ext. Cir. 203, 7 pp., illus.

9. GUILBERT, H. R., GERLAUGH, PAUL, and MADSEN, L. L., 1945. Recommended nutrient allowances for beef cattle, Natl. Research Council, 32 pp., illus.

10. LOUISIANA AGRICULTURAL EXTENSION SERVICE. 1943.
Pasture and feed—the foundation for profitable livestock. La. Agr. Col. Ext. Cir. 248, 30 pp., illus.

11. MEANS, R. H., and BENNETT, H. W., 1947.
Grazing beef cattle on winter growing crops. 1946-47 results. Miss. Agr. Expt. Sta. Cir. 133, 10 pp., illus.

12. PEEVY, F. A., 1949.
How to control southern upland hardwoods with Ammate. U. S. Dept. Agr. M-5296, 7 pp., illus.

13. RHOAD, A. O., and BLACK, W. H., 1943.
Hybrid beef cattle for subtropical climates. U. S. Dept. Agr. Cir. 673, 11 pp., illus.

14. WALKER, R. K., and STURGIS, M. B., 1946.
A twelve-month grading program for the rice area of Louisiana. La. Agr. Expt. Sta. Bul. 407, 19 pp., illus.

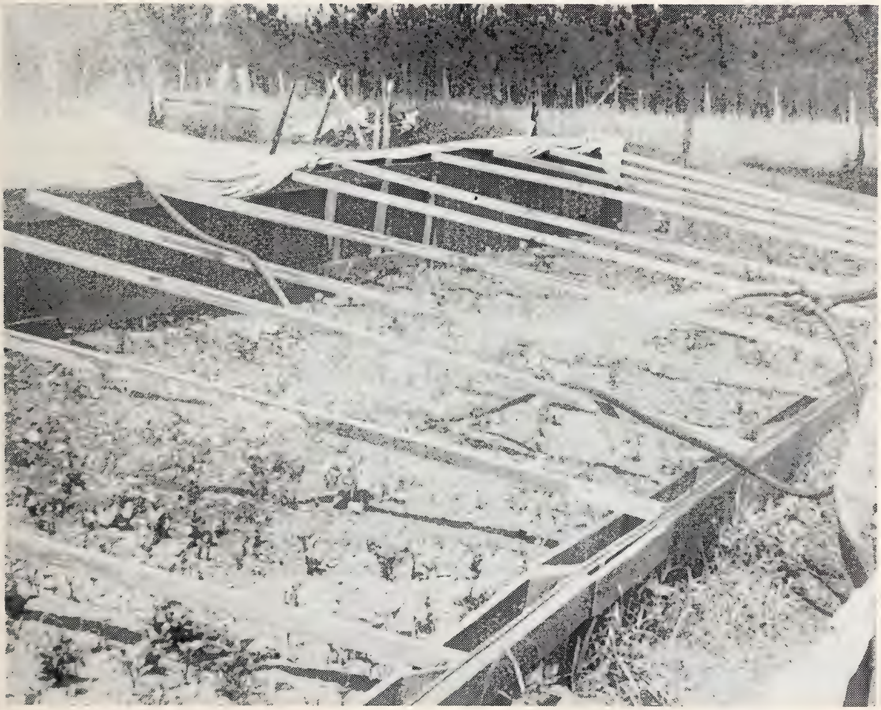
LOUISIANA BULLETIN NO. 453 MAY, 1951

SWEET POTATO HOTBEDS for LOUISIANA

By

WILEY D. POOLE

S. G.
ibrary
Coll.



LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, *Director*

SWEET POTATO HOTBEDS FOR LOUISIANA

WILEY D. POOLE, AGRICULTURAL ENGINEER

Farmers are aware of the importance of setting out sweet potato plants just as soon as possible after the danger of a late frost has passed. Having early plants available for field setting has many times resulted in additional cash returns to the farmer, wherein he was able to harvest early and take advantage of a higher price paid for early potatoes. In general, the ability to produce early plants has enabled the farmer to enjoy a longer growing season, and harvesting can be completed before the rainy season in the fall.

With the exception of the most southern part of the sweet potato area of Louisiana, it is advisable to utilize some type of hotbed for producing sweet potato plants large enough for field setting after danger of late frosts. In this bulletin consideration will be given to the most suitable location and types of hotbeds as well as the means for heating them under Louisiana's climatic conditions.

LOCATION OF THE HOTBED

Hotbeds should always be located on a well-drained site that is free from low spots and which will not flood during heavy rains. A location near the house where the beds can be given frequent attention is desirable. The artificial heat supplied to the hotbed is a supplement to the heat supplied by the sun; therefore, the hotbed should be located so as to be exposed to the sun as much as possible and also protected from the north wind. In locating the hotbed consideration should be given to the convenience of getting water piped to the bed, and gas or electricity if either is to be used as a source of heat.

SIZE OF HOTBED

Figure 6 shows three typical sizes of hotbeds which are laid out to use most economically the standard lengths of electric heating cable kits. Some of the larger commercial plant growers prefer the wider hotbed as shown in Figure 8. The size and number of hotbeds needed by the farmer will depend upon the acreage to be planted as well as the method used for planting this acreage. A small acreage might be planted with slips from the hotbed or a larger acreage may be planted from vine cuttings taken from early hotbed slips which were planted in the field. In determining the size of hotbed desired it should be remembered that approximately 12,500 plants are needed to set one acre of sweet potatoes on rows 3½ feet apart when the plants are spaced about 12 inches apart in the row.

Table 1 gives the number of plants needed to plant one acre for various row widths, as well as plant spacings of 8, 12, 18 and 24 inches.

TABLE I. Number of Plants Required for Setting Out an Acre of Sweet Potato Plants for Various Row Widths and Spacing of Plants on the Row

Row Spacing	Spacing of Plants on the Row (in inches)			
	8 inches	12 inches	18 inches	24 inches
36 inches	21,800	14,520	9,680	7,260
42 inches	18,700	12,444	8,296	6,222
48 inches	16,350	10,890	7,260	5,445
54 inches	14,666	9,680	6,453	4,840
60 inches	13,200	8,712	5,808	4,356

Results of various investigations indicate that for hotbed setting small roots will produce more plants than the larger roots. Edmond and Dunkelberg (2)[1] found that by crowding the roots in the hotbed a substantial increase in the number of plants per unit area resulted. This also appreciably reduced the labor and heat requirements per given number of plants. Therefore, to get the most out of the hotbed space it is recommended that as many roots as possible be placed in the bed, having each root placed as close to the adjacent root as possible without touching. Not allowing the roots to touch is a precaution to prevent rotting; however, research data indicate that roots' touching in the hotbed will not increase rotting if the seed stock is healthy and free from disease to start with.

A bushel of U. S. No. 1 seed sweet potatoes will generally produce in a hotbed 2000 to 2500 plants from a total of three or four pullings. A bushel of U. S. No. 1 seed potatoes will occupy about 15 square feet of hotbed space.

MATERIALS FOR CONSTRUCTING THE HOTBED

The Frame—A well constructed hotbed frame should be free of cracks which might let the heat escape. The cover should fit snugly to the frame on all sides. A suitable frame can be built of lumber 1 inch thick having the main supporting members made of 2" x 4" battens and stakes. If the bed is to be used for several seasons, then the lumber should be of a type such as cypress or cedar which will withstand the weather. Figure 7 shows a cross section of a typical hotbed 6 feet wide and having sides made of lumber. This type of hotbed is designed to use either glass sash or cloth as a cover. The suggested lengths for this type of hotbed when using electric cable for heating are shown in Figure 6. For a more permanent installation the sides and ends of the hotbed can be made of brick, concrete block or similar long lasting materials. There are a number of these types of hotbeds in Louisiana operated by large commercial plant growers. These beds are usually 10 feet wide and have a gable type of cover framing as shown in Figures 1 and 8. The length of the hotbeds when using hot water is usually 60 feet. It is not necessary to excavate below the ground surface in building the artificially heated hotbeds. This frame should be laid out on a well-drained, fairly level spot. If the location is on a slight slope a drainage ditch should be dug on the uphill side to prevent rain water from entering the bed. Figure 7 shows a cross section of a hotbed and the drainage ditch on the uphill side.

---

[1] Numbers in parentheses refer to literature cited, Page 24.

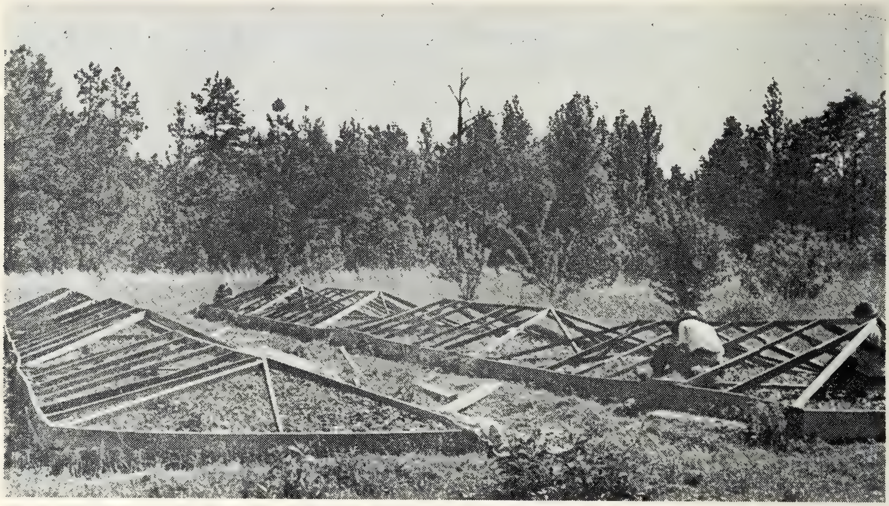


FIG. 1—Wide Gable-framed Hotbed.

The Cover—Hotbed covers may be of glass sash, glass substitute fabric, treated heavy muslin or similar material. Of these covers the glass sash has probably been used more extensively than any other type. This is primarily because of its long lasting quality and ease of handling. The standard glass sash is 3 feet wide and 6 feet long. Glass substitutes, such as Sunray cloth and Sunray glass, have become increasingly popular lately because of a much lower cost than glass sash. In testing glass substitutes, Zahour (1) reported that clear cellulose acetate film appeared better than glass for sash glazing as the cellulose film showed a lower heat consumption and wider transmission of solar rays, resulting in a more uniform temperature and humidity essential for normal plant growth.

Heavy cloth covers are used extensively in the South on large installations of sweet potato hotbeds. Experiments conducted by engineers of the Louisiana State Agricultural Experiment Station showed that under Louisiana conditions, when comparing glass sash and cloth cover, the cloth cover produced plants at a slightly lower consumption of heat but the glass sash produced plants slightly earlier than the cloth covered hotbeds. Cloth covers must be well fastened to the hotbed frame to prevent the wind from whipping the fabric loose. Some type of pole should be fastened to the lower end of the cloth cover to keep it weighted down. This pole attached to the lower end of the cover will facilitate easier handling of the cover when rolling it back for sunning the beds. Non-transparent coverings must be rolled back during the day to let the sunlight reach the plants after they sprout.

Insulation—Because of the reasonably mild weather during the period of operating the sweet potato hotbeds, the use of commercial insulation of these hotbeds is not recommended. However, the use of insulating materials such as pine straw, sawdust, chopped corn cobs and chopped hay which are obtainable around the farm at no additional cost, is recommended. Ordinarily, heat loss through the soil under the hotbed is small as compared to the losses through the sash and frame. Research studies were conducted to determine to what extent the heat consumption of a hotbed could be reduced by utilizing from 3 to 4 inches of farm waste material such as pine straw, chopped hay or cornstalks, or wood shavings under the heating cables or pipes in the hotbed. Results of these experiments showed that when using such insulation an average saving in heat consumption as great as 15 to 20 per cent could be expected. This insulating layer is shown in the cross section drawing of a hotbed in Figures 7 and 8.

It is also recommended that farm waste insulating material as mentioned in the above paragraph be piled around the outside ends and sides of the hotbed to give further protection from the cold air. All cracks in the hotbed should be sealed tight to prevent leakage.

Bedding Media—A sandy loam type of soil has been used more extensively than any other material for bedding down sweet potatoes in the hotbed. Sand and sawdust are sometimes used but if no additional plant food is to be added to the bedding media, it is recommended that a sandy loam soil be used. Edmond and Dunkelberg (4) found that when comparing soil and sand as a bedding media, little difference, if any, existed in total plants produced when equal amounts of commercial fertilizer were added. However, a great deal of difference in favor of soil existed when soil alone and sand alone were compared. It would then seem that the most influential factor in the bedding media for producing plants is the plant food present. Therefore, it is recommended that commercial fertilizer be added to and thoroughly mixed with the bedding media to increase plant production of the hotbed. The rate of application should be approximately 350 pounds of 5-10-5 per acre, which would be one pound of fertilizer spread over 124 square feet of hotbed surface.

If a fine loam soil is used as a bedding media there is danger of a crust forming from frequent watering. To prevent this it is recommended that a layer of 1 to 2 inches of sawdust or sand be placed on top of the bedding soil. To prevent moving or disturbing the mother potato when pulling slips, a layer of poultry wire should be placed over the entire bed after the sweet potatoes are placed in the hotbed. The location of the poultry wire, sawdust, etc., is shown in the cross section view of a standard hotbed in Figures 7 and 8.

METHODS OF HEATING HOTBEDS

Many research workers have conducted experiments to determine the optimum temperature to hold the sweet potato hotbeds for the most economical plant production. It is generally considered that the temperature of the potato should be between 80° F. and 85° F. Edmond and Dunkelberg (2) narrowed this range down to 83° F. to 85° F. The more closely the optimum temperature is maintained within a sweet potato hotbed the greater will be the efficiency of plant production. In south Louisiana it is a common practice to depend upon field setting for plants. However, adverse weather conditions such as cold rains or a late cold spell render this practice very uncertain for the very early slips. Table II gives the average minimum temperature for the various sweet potato areas of Louisiana during the three months in which sweet potato plants are being grown for field setting. It is obvious that these temperatures are far below the recommended temperature for favorable plant growth. In several areas of the state some use is being made of hotbeds without any source of heat other than the sun's rays during the day. The hotbed frame and cover are the same as that of the heated type. During cold spells or cool nights the hotbed frame and cover offer some protection and tend to hold the heat accumulated during the day. Another practice in the speeding up of plant production is to cover the top of the rows of the seed bed in the field with a lightweight, black building paper. This paper will absorb much of the sun's rays during the day, consequently transmitting this heat to the seed potato in the row and speeding up plant production. This paper will also protect the row from cold winds and tend to hold the heat in the row. The paper can be removed after the plants come up and danger of frost is over.

TABLE II. Average Minimum Temperatures for the Sweet Potato Areas of Louisiana

	Length of record in years	Minimum Temperatures		
		March	April	May
Shreveport	56	48.8	56.3	63.6
Alexandria	36	49.3	55.5	62.6
Monroe	43	47.1	54.5	62.0
Baton Rouge	43	51.7	58.0	64.1
St. Francisville	19	49.5	55.3	62.4
Opelousas	26	50.1	55.8	62.6
Lafayette	38	51.2	57.1	63.3

Manure-heated Hotbeds—Probably the oldest method of supplying heat to a hotbed is the use of fermenting manure. It is still widely used, but because of the scarcity of a good grade of horse or mule manure, the danger of spreading diseases, and the larger amount of labor required in setting up this type of hotbed, its use on a large scale has rapidly declined. However, for the smaller farmer who has horse or mule manure available it is still a very economical method of supplying heat to a hotbed.

The frame for the manure hotbed can be the same as that used for other types of hotbeds as shown in Figure 2.

The first step in constructing a manure-heated hotbed is to locate a good well-drained spot. The pit should be laid off with a line attached to stakes and then dug to the desired depth. The width and length of the hotbed will be governed by the number of plants needed. A bed 6 to 12 feet should produce enough plants to set one acre of sweet potatoes. If the soil where the hotbed is located is a sandy loam and clean and free of disease it may be used to put back in the bed for bedding the roots in. However, if there is any doubt about its being free of disease it is recommended that new soil be hauled in from a field which has not been planted to potatoes for the past four years.

Manure for use in hotbeds should consist of a good grade of straw bedded horse or mule manure, and should be hauled direct from the stable and not allowed to remain in piles and lose its heating qualities. As it is hauled from the stable it should be placed in broad flat piles alongside the hotbed, where it should remain for 2 to 3 days until it begins to heat. It should then be turned or forked over so as to secure uniform composition and heating. In case the manure is dry and shows a tendency to burn, a little water should be added as it is being turned. As soon as the manure has begun to heat uniformly, which should take about 4 or 5 days, it can be forked into the hotbed pit. It should be spread into the hotbed and watered if dry.

The depth of the manure in the hotbed will depend upon the outside temperature for that locality. For Louisiana, about 8 inches of manure should be sufficient. Figure 2 shows a cross section view of a manure-heated hotbed showing placement of manure, soil, potatoes and cover.

Chopped cornstalks can be used as a substitute for manure if such becomes necessary. The cornstalks used for this purpose should be gathered early as possible in the fall, after the corn has been picked, and stored where they will be protected from the weather. When the hotbed is ready to be prepared, the cornstalks are run through a silage cutter, then moistened and packed in the pit of the hotbed in the same manner as manure. The chopped stalks go through a fermentation process which gives off heat to the hotbed. However, the amount of heat given off by chopped stalks will depend upon the extent to which the stalks have aged before placing them in the hotbed. Under normal conditions the chopped cornstalks can not be expected to give off as much heat as fresh manure, and so a cornstalk-heated bed may be lacking in heat if a long cold spell develops.

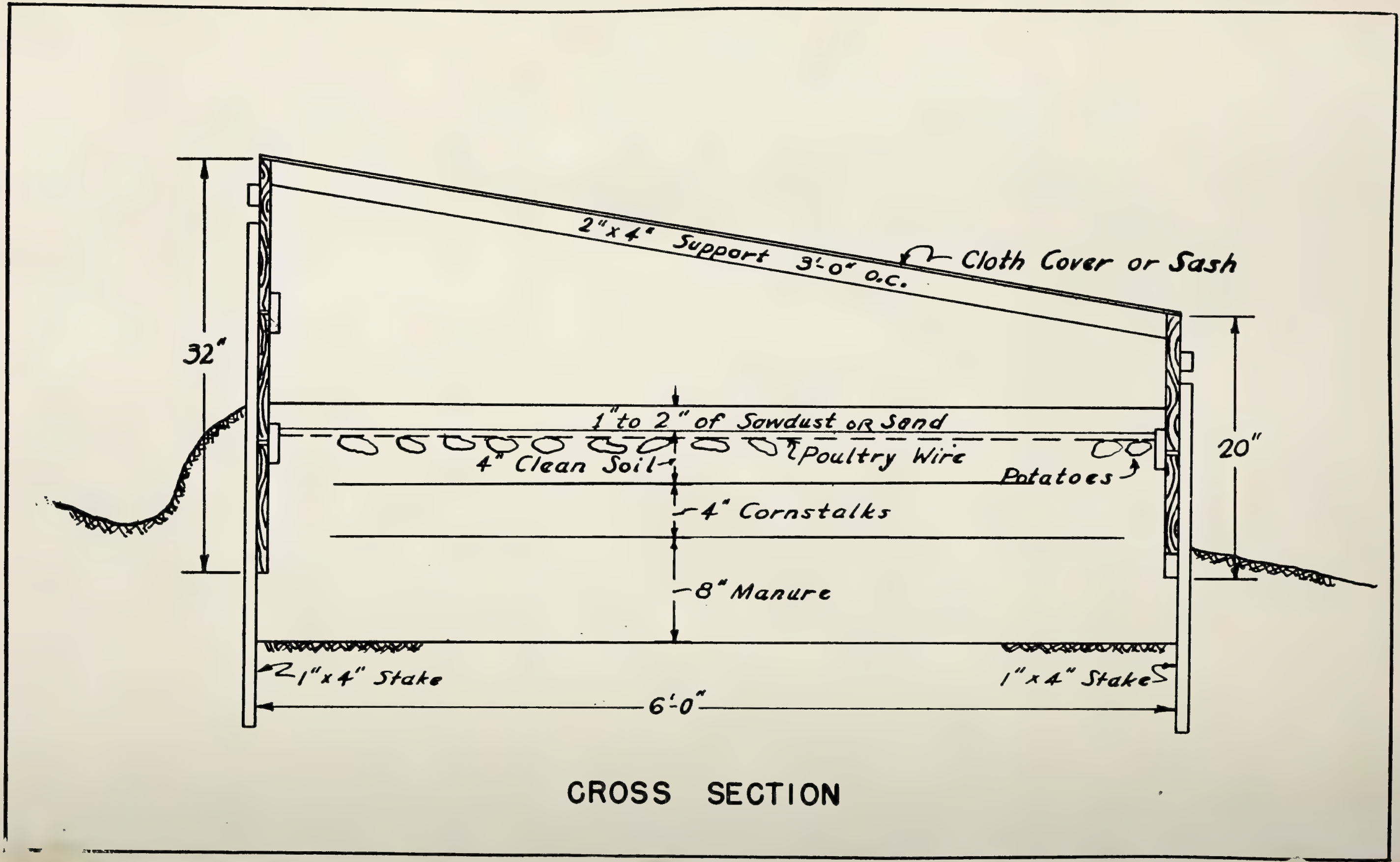


FIG. 2.—Cross Section [illegible] of a Manure-heated Hotbed.

Black rot is the major disease affecting Louisiana's sweet potato crop and it can be readily spread through using contaminated soil and manure in a hotbed. It is believed that diseases are so easily spread through the use of manure in hotbeds that many agricultural workers discourage the use of manure as a source of heat for sweet potato hotbeds. However, if it is necessary to use it as a source of heat for hotbeds, all precautions for cleanliness should be taken to avoid disease spread, and the bedded roots should never be allowed to touch the manure. It should be remembered that a manure-heated bed involves considerably more labor in preparation than other types, such as electrically heated beds; however, it requires no more labor in tending than other types and less than the flue-heated beds.

Flue-heated Hotbeds—Fuel-heated beds of various types have just about replaced all of the manure-heated beds, especially in sections where fuel is cheap and the supply of manure is limited. Probably the oldest of the fuel-heated beds is the flue-gas heat. There are a number of ways in which the hot flue gases can be used to heat up a hotbed. Figure 3 shows a typical two-ditch, flue-type hotbed. Referring to Figure 3, it should be noted that the sides and frame of this flue-heated hotbed are made of 1 by 12 inch boards and 2 by 4 frame work. The 2 by 2 rafters for holding the cover are usually on 4 foot centers. Heavy cloth muslin is usually the cover used on this type of bed but they can be laid out for using glass sash just as well. The two-ditch type will vary in width from 7 to 9 feet and is usually 30 to 40 feet long. The flue hotbed is located on the side of a sloping hill preferably having a drainage ditch at the lower end for the starting of the fire box and to eliminate the danger of flooding the fire chamber during rains. The flue ditches are dug up the hill and covered with green wood slabs as shown in Figure 3. A clay soil is placed over the slab about 9 inches deep at the furnace end and about 4 inches deep at the smokestack end. About 6 inches of good sandy loam top soil is placed in the bed for bedding the roots. The smokestack is usually 8 by 8 or 10 by 10, made of lumber or pipe, extending 5 to 6 feet above the surface of the ground. The fire box located at the lower end of the bed is usually made of three old 50-gallon steel oil barrels with each end cut out. A piece of sheet iron held in place by an iron bar is used as a front door for the furnace. When an extremely slow fire is desired a flat block is laid partly over the chimney. Chunks of wood about 18 inches in length and 6 to 10 inches in diameter are used as fuel, and green sawdust is frequently placed on top of the wood in the furnace to give a slow-burning or smoldering fire. According to growers using this type of bed it will require about one cord of wood for each bed during a plant growing season. These flue fire boxes will require tending 2 to 3 times a day.

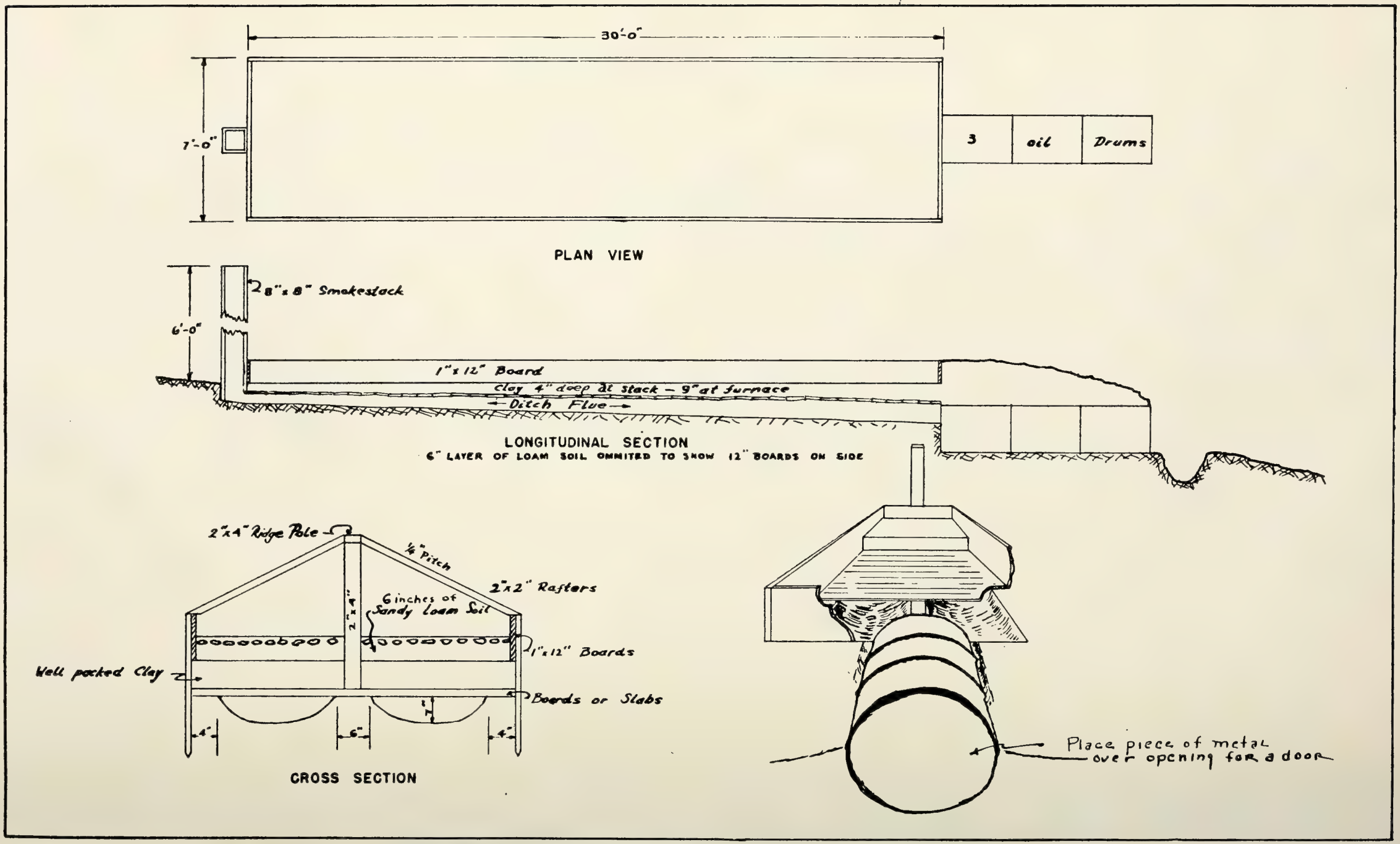


FIG. 3.—Plan for a Two-ditch Type of Flue-heated Hotbed.

Figure 4 shows a typical single-ditch hotbed. These are usually 6 feet wide and not over 50 feet long. Old roofing metal, etc. can be used to place across the flue ditch provided some old pipe or iron is placed across the ditch about every 2 or 3 feet under the metal.

Provided wood is plentiful and labor is available at a low cost, the flue-heated hotbed can be an economical method of growing sweet potato plants on a large scale. It is probably lower in first cost to build, since controls, pipe, wire, etc. are not used, as compared to the electric and hot water hotbeds. Some of the disadvantages of using this method of heating hotbeds are as follows: requires more labor for constant tending of the fires during cold weather; greater temperature fluctuation in the hotbed due to unsteady fire, must be on a large scale to make operation economical.

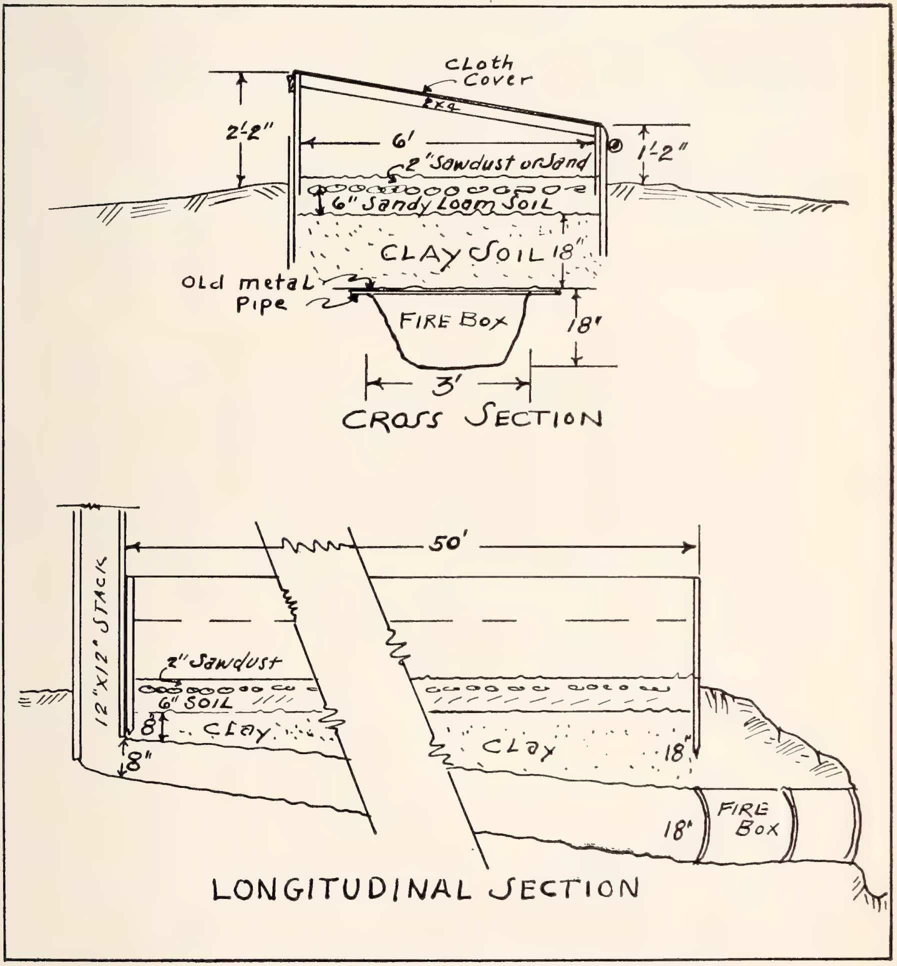


FIG. 4.—Details of a Single-ditch, Flue-heated Hotbed.

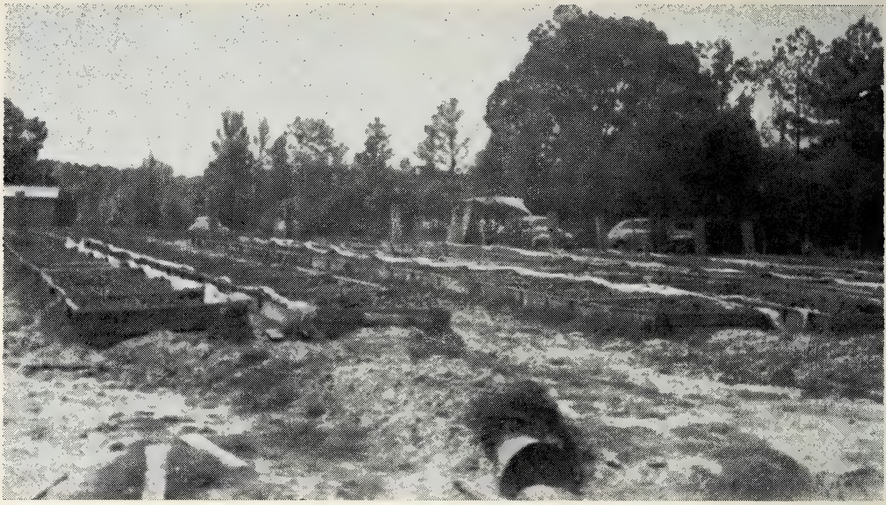
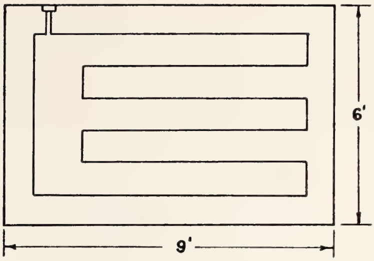


FIG. 5.—Flue-heated Hotbed.

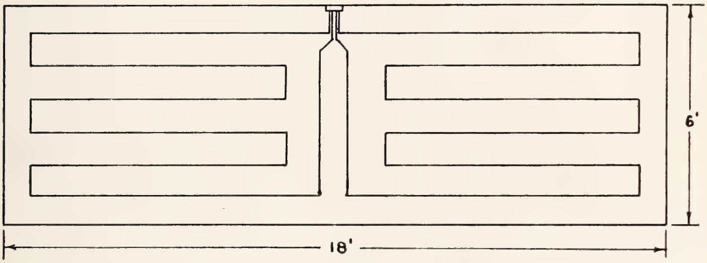
Elctrically Heated Hotbed—A special flexible electric soil-heating cable has fast become the most popular method used in Louisiana for heating hotbeds. This popularity of the soil-heating cable can be attributed to several factors. One is that recently electricity has been made available to practically all farmers. Electrically heated hotbeds are thermostatically controlled and therefore require very little tending; at the same time, the hotbed maintains a very constant heat even with fluctuating outside temperatures. They require less labor to construct and no fuel has to be hauled and no firing done. It is probably the best suited method for heating a small bed for the farmer who wants to put in one 6 by 9 or 6 by 18 feet bed as shown in Figure 6.

The soil heating cable consists of a high resistance conductor covered with felted asbestos, varnished cambric, and a protective lead sheath. Owing to its electrical resistance it must always be used in a 60-foot length on 115 volt circuit and a 120-foot length on a 230 volt circuit. The 60-foot length is rated at 400 watts and the 120-foot length is rated at 800 watts. Results of tests under Louisiana conditions show that about 7 watts per square foot is all the heat necessary for growing sweet potato plants in a hotbed. Based on this figure for heat requirement and the standard lengths of electric cable, 60 feet for 115 volts and 120 feet for 230 volts, three sizes and placement of electric heating cable for each size are shown in Figure 6. Some companies now have available soil heating kits which consist of one soil thermostat with plug receptacle attached and one or two 60-foot lengths of heating cable. The heating cable in this case will have a heavy duty male plug on the end for plugging into the receptable. Figure 10 shows the standard kit unit plus a switchbox.

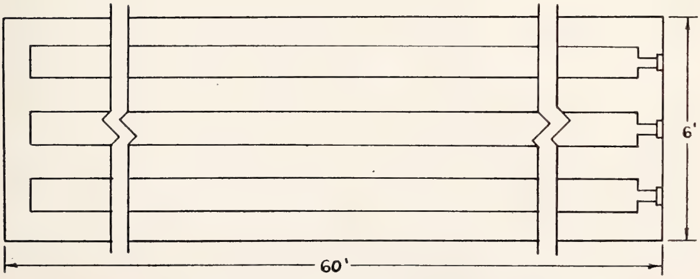
For large installations where much of the heating cable is to be



ONE 60' CABLE - 115 VOLTS



TWO 60' CABLES - 115 VOLTS



THREE 120' CABLES - 230 VOLTS

FIG. 6.—Three Sizes of Hotbeds Showing Placement of Standard Lengths of Electric Heating Cable.

used it is more economical to buy the heating cable in bulk quantity in multiples of 60 or 120 feet. The bed can then be wired by the farmer or an electrician in a manner shown in Figure 9. By knowing the load for each length of cable, the proper size wire for handling the bed can be obtained from Table III.

The general construction of the hotbed frame and suitable size for locating the hotbed are the same as covered in previous paragraphs under those topics.

It is known that the roots produce the maximum amount of plants when held between 83° F. and 85° F. Therefore, in order to maintain an even temperature at the level of the roots in a hotbed, the heating cable should be placed at a definite depth below the roots for a given spacing. Studies on this subject were conducted under controlled conditions in the laboratory and results of the tests indicate that a uniform temperature in the hotbed at the level of the bedded roots can be obtained if the following ratio of cable spacing and depth of cable below roots is followed: for a cable spacing of 10 inches, distance of cable under roots should be 3 inches; for a cable spacing of 12 inches, distance of cable under roots should be 4 inches; for a cable spacing of 14 inches, distance of cable under roots should be 5 inches.

TABLE III. Wire Size to Use in Running 115 and 230 Volts Extensions Varying in 100-Foot Lengths, from Metering Point to Hotbeds of Sizes Shown. These are the Sizes of Wires Required to Keep the Voltage Drop Below the Maximum Allowed for Economical Operations.

Length of Soil Cable In Feet	DISTANCE — FEET 100	200	300	400	500	750	1000
	Wire Size Required						
	115 VOLTS						
60	10*	10*	10*	10	10	8	8
120	10*	10*	10	10	8	6	4
180	10*	10*	8	8	6	4	4
	230 VOLTS						
240	10*	10*	10*	10	8	8	6
360	10*	10*	10	8	8	6	6
480	10*	10*	10	8	8	6	4
600	10	10	8	8	6	4	4

* Minimum size allowed by National Safety Code for outside overhead conductors.

Figures 7 and 8 show cross section views of a standard 6-foot and 10-foot electrically heated hotbed. These figures show the recommended insulating layer between the cable and the ground, the spacing of the heating cable, and distance for bedding the roots above the cable. The sawdust or sand layer above the roots prevents a crust from forming and makes pulling slips much easier. The poultry wire above the roots is to prevent disturbing the roots when pulling slips.

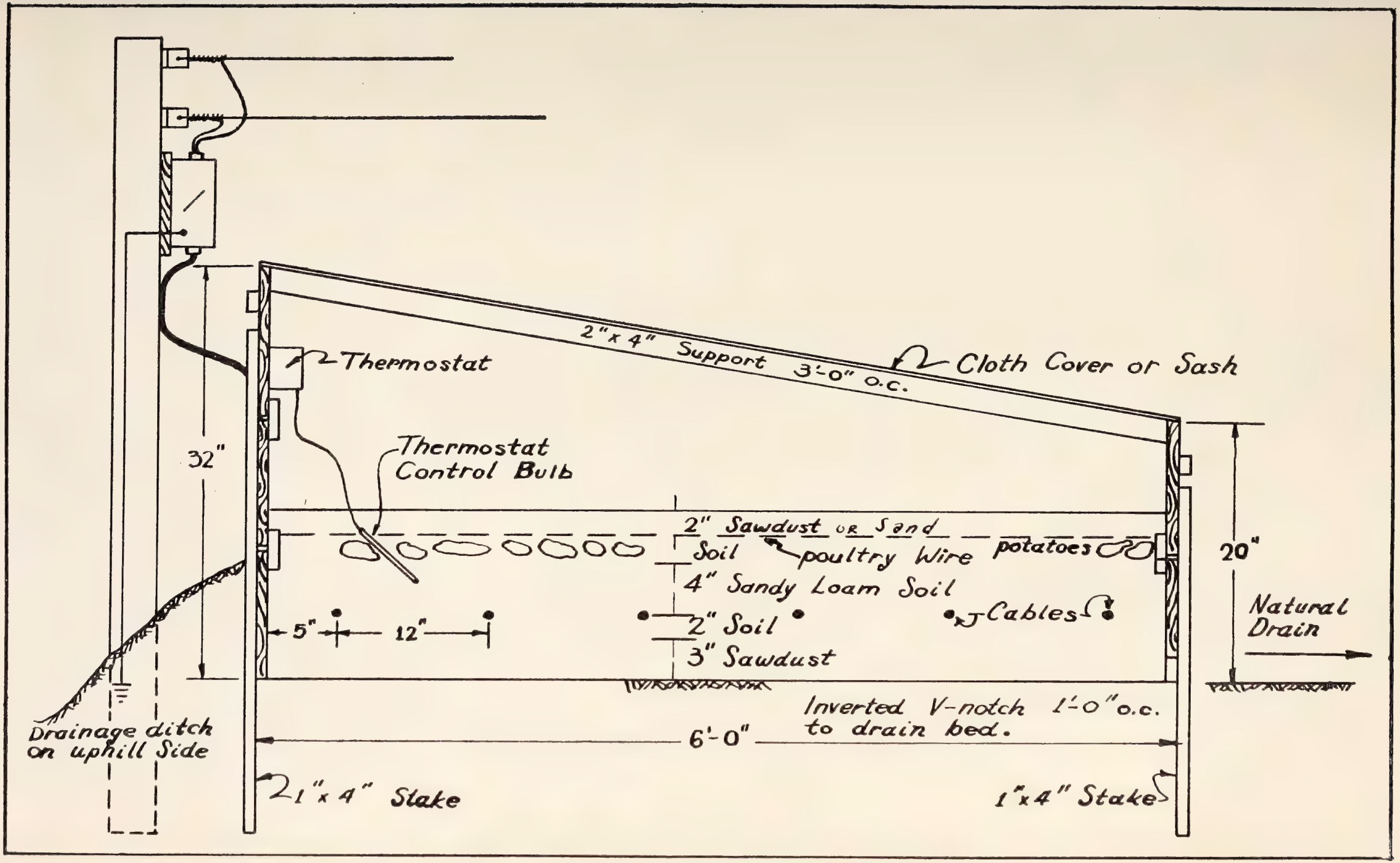
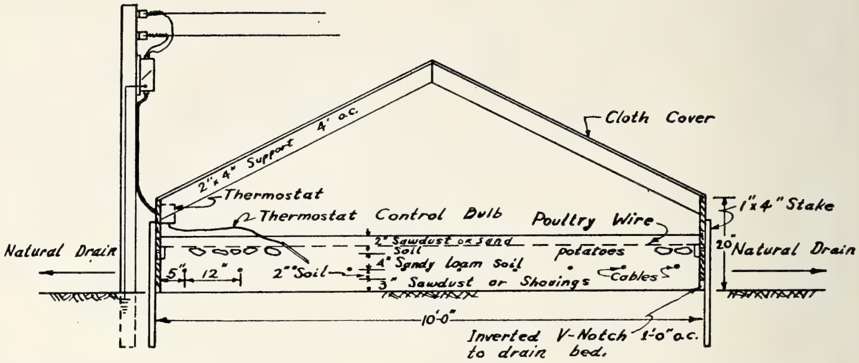
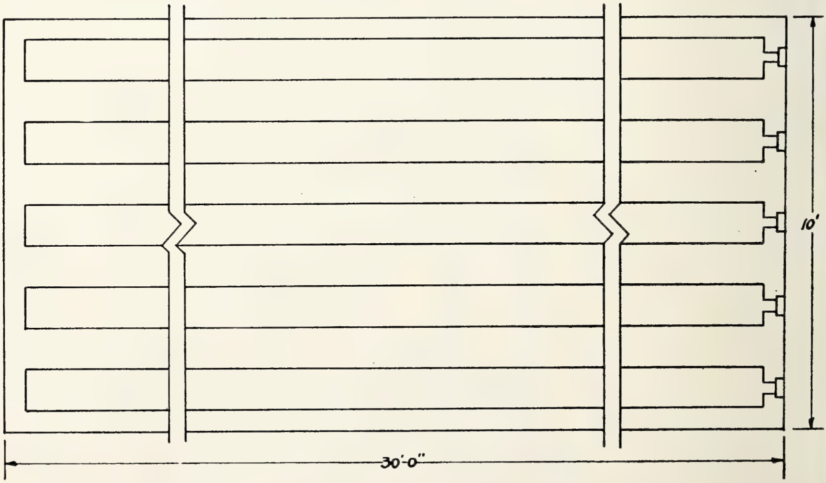


FIG. 7.—Cross Section View of a Typical Sash or Cloth Covered Hotbed.



CROSS SECTION



FIVE 60' CABLES - 115 VOLTS

FIG. 8.–Cross Section Detail and Electric Heating Cable Layout for the Wide Type of Hotbed Used by Commercial Plant Growers.

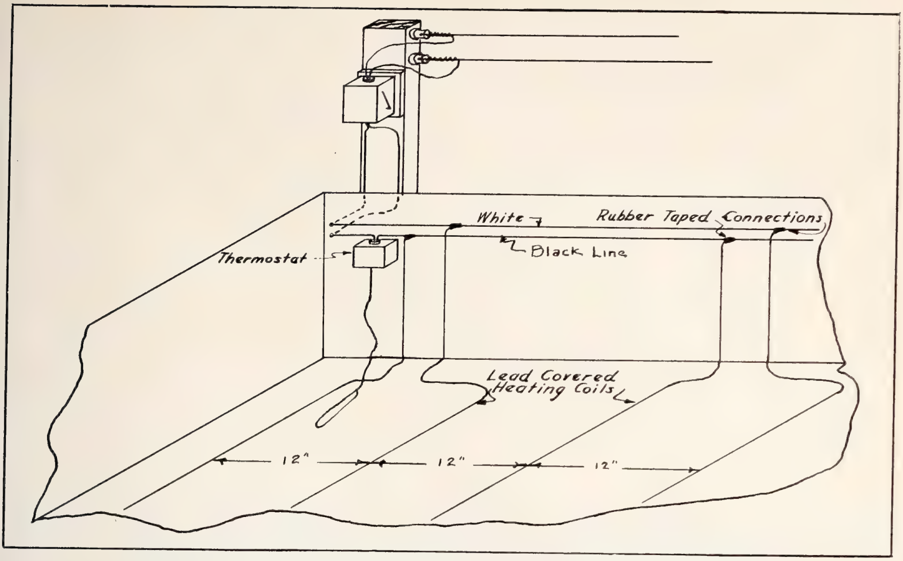


FIG. 9.—Wiring Connections for Electric Cable-Heated Hotbed.

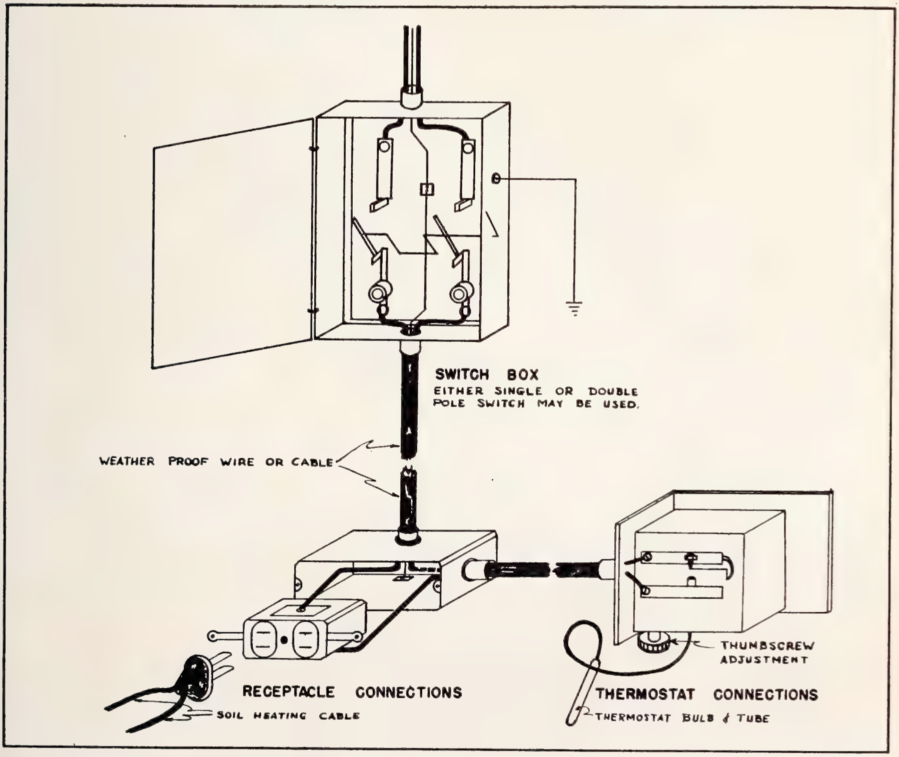


FIG. 10.—Wiring Connections for an Elecrtic Cable-Heated Hotbed Showing Thermostat, Switch Box and Receptacles.

All precautionary measures as to using clean disease-free soil for bedding the roots, etc., as discussed under manure-heated beds also applies here. If the hotbeds are to remain in the same location year after year, then the bedding soil down to the heating cable should be removed and replaced with fresh soil at the time of bedding in the roots in spring. In removing this soil it is very easy to cut or damage the heating cable, causing faulty operation. To eliminate this damage many operators have covered the cable with half-inch mesh hardware cloth. Damage from cable cutting can be very expensive.

The thermostat plays a very important part in the hotbed operation. It is the instrument that keeps the hotbed at the proper temperature. If its operation is faulty, serious damage might result to the roots in the hotbed. It is recommended that the thermostat be tested each spring before the hotbed is put into operation. The method used for properly adjusting the thermostat is discussed in a later paragraph under "Operating the Hotbed."

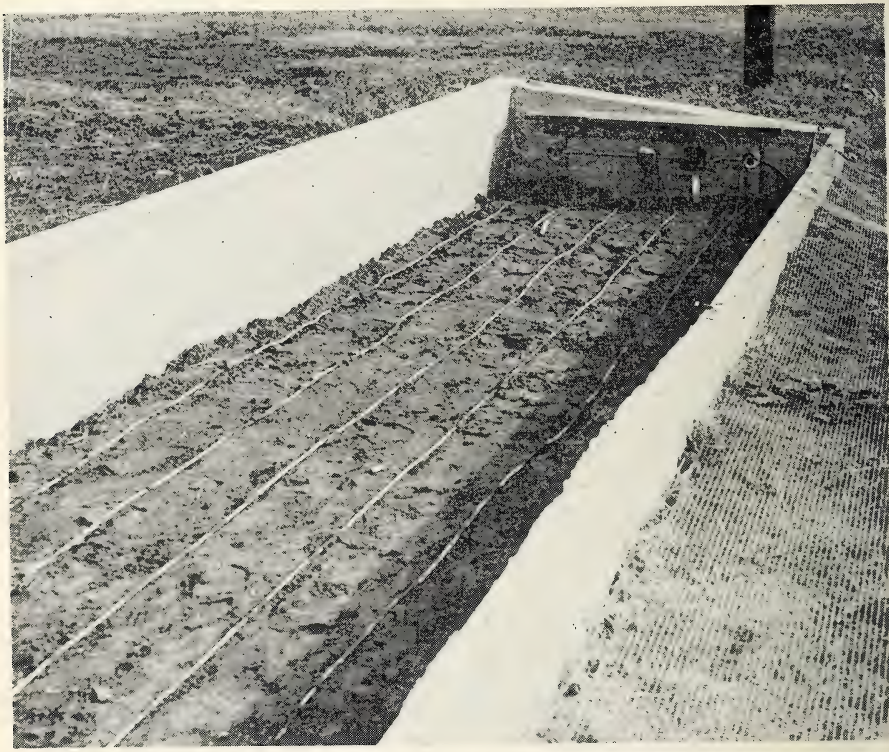


FIG. 11.—Electrically Heated Hotbed Showing Electric Heating Cables in Place.

Results of tests on the operation of electrically heated hotbeds indicate that for average conditions electric heat is supplied to a hotbed for a period of 10 to 14 hours each day. As would be expected, this heat is supplied during the night and practically all day on dark days.

Data taken on the electricity used on a number of hotbeds for the past several seasons show that the average consumption of electricity for the period of operation is from 4.5 to 6.5 kwh per square foot of hotbed surface. The period of operation is usually 6 to 7 weeks.

The use of electric light bulbs is another method by which electricity is used to heat the hotbeds. This method has become particularly popular for small installations such as from one to three beds. If properly installed, the electric light bulb installation is no cheaper in first cost than the electric cable hotbed. However, the ability to procure the bulbs and sockets at the local store, when needed on short notice, has probably been a deciding factor many times. The electric heating cable is not usually stocked by the local dealer and so entails a delay in ordering. If electric bulbs are to be used the wattage per bulb should not be larger than 50 watts. This is advisable so as to get an even distribution over a greater surface and not tend to concentrate too much heat under one bulb, which is highly possible if a large wattage were used. The wattage per square foot should be figured as 7 watts, the same as for the cable, and the number of bulbs necessary to cover the hotbed spaced as evenly as possible. The bulb sockets and electrical connections should be weather proof to prevent shorting out while watering the beds. It is advisable to cut off the electricity to the hotbed while watering. Figure 12 shows a sweet potato hotbed equipped with 25-watt electric bulbs as a heating source. Test data collected over several years indicate that there is practically no difference in the electricity consumed for heating between beds using heating cable and those using the light bulbs. Some research workers feel that after the plants are up the electric light bulb offers additional stimulation to plant growth. The use of light bulbs

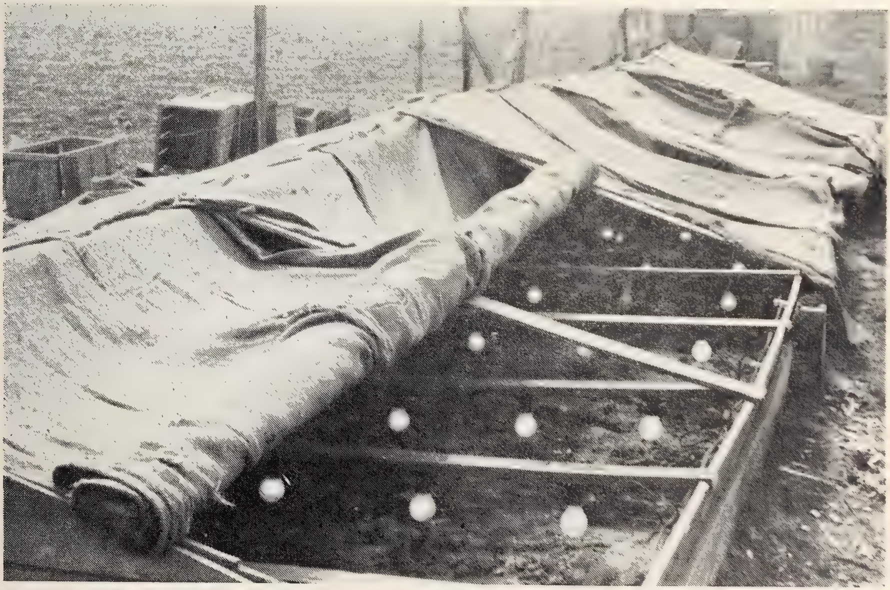


FIG. 12.—Hotbed Using 25-Watt Electric Bulb as a Source of Heat.

as a source of heat has become popular for cold frame beds when heat is needed. These are usually connected up without use of thermostat and turned on by the operator only when he decides some heat to the cold frame is advisable.

Some of the disadvantages of using electric bulbs are as follows: high breakage of the electric light bulbs; in the way for both watering and pulling plants; must be disconnected and removed for cleaning the beds at end of each season; and requires storage space when not in use.

Hot Water-heated Hotbed—The use of hot water circulated in pipes buried in the soil of the hotbed has been gaining in popularity for large-scale commercial operators. The frame of the hotbeds using this method for heating is usually the wide gable cover type as shown for the electric bed in Figure 8. The building of the frame and placement of soil, etc., are the same for the hot-water system as have been described for the electric cable system. The only difference is that half-inch pipes are placed where the electric cables are shown in the drawing. The hot-water beds are usually 60 feet long and another bed is set behind the first so that the hot-water pipes can run the full length of the two beds before returning. Figure 13 is a schematic diagram showing all the components that go to make up a hot water-heated system. The principle of operation is briefly as follows: Water is taken from the open surge tank by the electrically driven centrifugal pump and forced under pressure through the heating coils, where the water is heated; it is then forced into the hot-water header line, which is a large line that runs at the head of each row of hotbeds; from this header line half-inch pipes run the length of each of the two beds, then turn on a one-foot radius bend and return to the head of the two beds where they empty into a cold-water header line and return to the open water surge tank to be pumped again through the system. The duration of operation is controlled by a thermostat just as in the electrically heated system. However, in this case the thermostat makes an electrical connection when the beds become cool, which allows the electric motor to start pumping and at the same time opens a magnetic valve that starts the gas burner to burning under the water coils. When the beds are warm enough, according to the setting of the thermostat, the electrical connection is broken, thereby stopping the electric pump and shutting off the gas burner.

The discharge and return pipes in the hotbed can be one-half-inch regular screw thread or copper pipe and are spaced 12 inches apart as shown in Figure 8. The header lines running at the head of the beds are 1¼ or 1½ inch pipe.

The amount of heat supplied the hot-water beds is the same as for the electrically heated beds but is quoted on a BTU basis, which is a standard measurement of heat when dealing with fluids. For the electric beds, 7 watts of electric heat per square foot was the basis for arriving at the required heat. Since 1 watt is equal to 3.412 BTU, the heat load for the hot-water bed will be 7 x 3.412, or 23.884 BTU per square foot

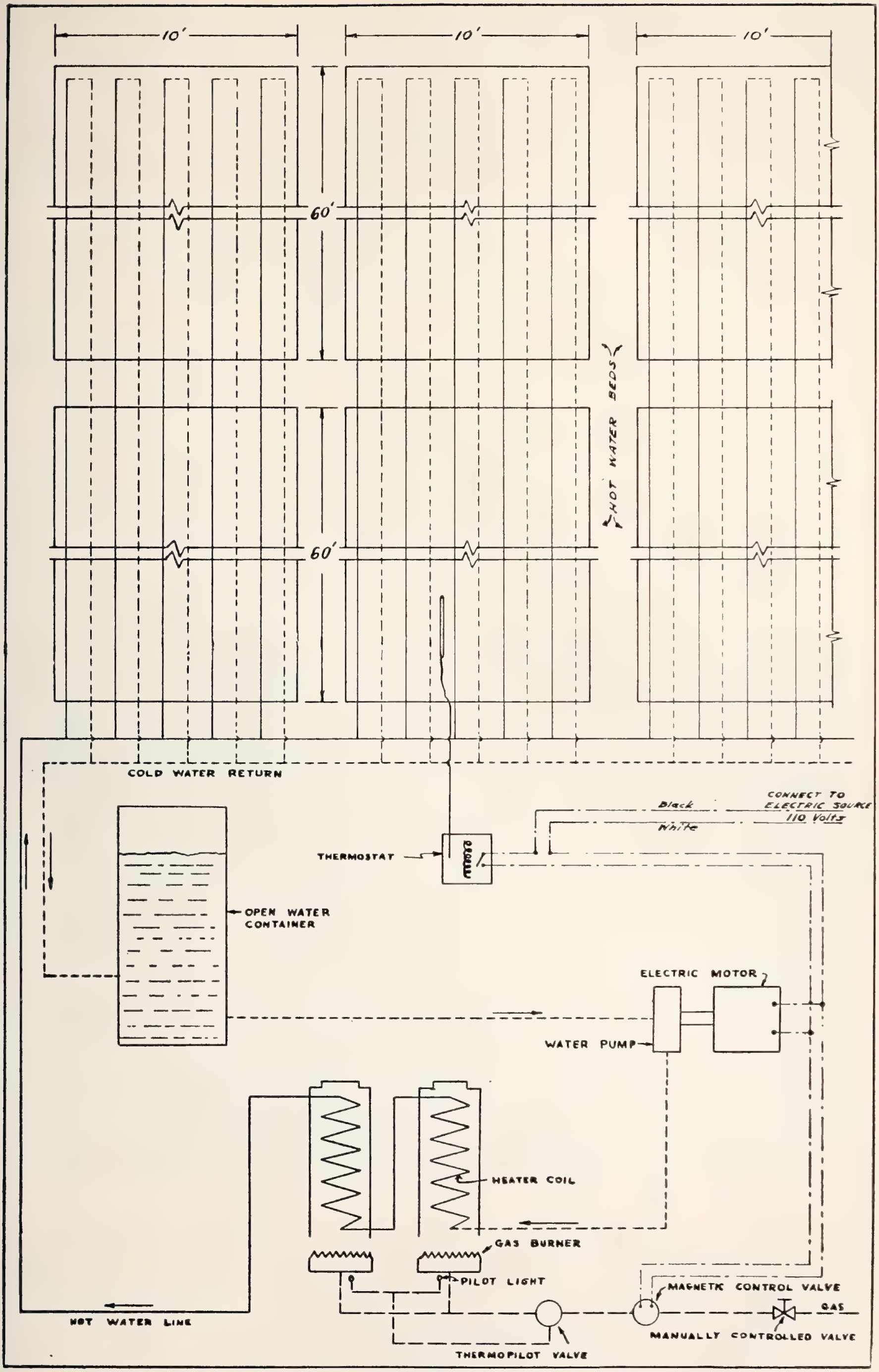


FIG. 13.–Layout Diagram for a Six-Bed, Hot Water-heated Hotbed System.

of bed. By taking the total area of the hotbeds and multiplying that by 23.884 the amount of heat necessary for the installation can be figured. It is wise to allow approximately an additional 4 to 5 per cent of heat requirement to compensate for the heat lost in the header lines.

The hot-water coil heaters together with the gas burners can be obtained from a number of hot-water heater manufacturers. These are given a BTU rating so that the desired size can be obtained. These units are compact, easy to install, and fairly efficient.

It is possible for a farmer to make his own heater coil by coiling the correct length copper pipe and mounting it in a suitable size drum, but some skill is required in turning a good coil without forming a sharp kink which would retard the flow of water. Figure 14 shows a homemade heating coil and gas burner installation in a 50-gallon oil drum and the electric contrifugal pump for circulating the water.

Using as an example the hot water-heated hotbed installation as shown in Figure 13, sample determinations will be made for selecting the size of heating system and motor-pump unit. The total area of the six beds will be 3,600 square feet. Using the round figure of 24 BTU per square feet as arrived at in a previous paragraph, the necessary heat to be supplied the hotbed will be 86,400 BTU per hour. Allowing 3,600 BTU for heat loss in the header line will bring the total heat necessary to 90,000 BTU per hour. This heat will have to be supplied by the circulating water. From previous experience it is known that the temperature drop in the lines in a hotbed of this length should be about 14 to 16 degrees F. for sweet potato plants. The thermostat should be set so that the mean temperature between high and low is about 83

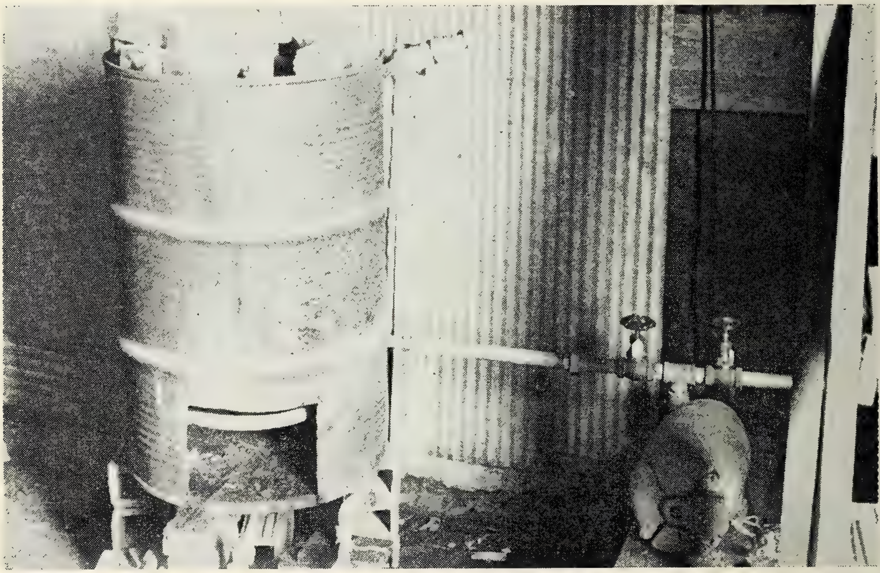


FIG. 14.—Coil Heater and Pump for a Hot Water-heated Hotbed.

degrees F. This means that approximately 11 gallons of water per minute must be circulated against a friction head of about 78 to 80 feet.

From a pump catalog a three-fourth inch centrifugal pump capable of 10 to 15 gallons per minute operating at a head of 80 feet can be selected. This pump is driven directly by a three-fourth H.P. electric motor. It is definitely recommended that the motor-pump unit be direct driven, as a belt driven unit may cause damage in the event the belt breaks.

From a heater company catalog select a coil heater whose capacity in BTU output of heated water equals the calculated heat required for the hotbed system. It is often necessary to use two heaters as shown in Figure 13. In this event it is recommended that the heaters be connected in series so that all the water circulated must pass through the coils of both heaters.

The chief advantage of this hot-water system is the low cost of operation due to the plentiful source of cheap natural gas in Louisiana. The first cost of the pump, heater coils and pipes makes it the most expensive system to set up, but according to operational results kept for the past several years this high first cost is quickly offset by the low operational cost for a large hotbed system. It requires the same amount of labor for tending as the electric heating system. It has a low replacement or upkeep cost, as the pipes are never damaged when replacing the soil in the hotbed as is sometimes the case for the electric heating cable. Its chief disadvantage is that it cannot be installed on a small size hotbed, since the smallest motor-pump unit and coil heater is too large and expensive for a small installation.

OPERATING THE HOTBED

Thermostat Adjustment—When using electric cable, electric lights or circulating hot water, the thermostat is the instrument that keeps the bed at the proper temperature. It should be checked before putting the bed into operation each spring. Some thermostats have degree markings on the adjustment screw dial. It should never be taken for granted that these graduations are correct until proven by testing. The temperature setting can be adjusted in the following manner: Place the thermostat bulb in a container of water which is 85° F. as measured by a reliable thermometer. At this temperature the electrical contacts should separate or be adjusted to separate. Then place the bulb in water at 80° F. and the contacts should come together again. For adjusting the setting the adjustment screw on the thermostat can be turned counterclockwise to raise the temperature and clockwise to lower the temperature setting. When the proper thermostat setting has been determined, the bulb should be placed in the bed at the same level as the potatoes. A thermometer should be inserted in the bed to the depth of the potatoes and preferably located so that it can be read without disturbing the cover. The thermometer should be read daily to ascertain that the bed is heating properly. After the heat is turned on, the bed should warm up to 80 to 85° F. in a couple of days.

Cover—It is necessary to have cloth, glass, or glass substitutes to cover the bed at night if economical operation is expected. In order to conserve fuel the cover should remain over the bed during cool, cloudy days.

Watering—The bed should be watered after the potatoes have been placed in the bed, and watering thereafter will depend upon type of heat and weather conditions, but frequency of watering will be from once to twice a week.

Ventilation—When the sprouts begin to appear in the hotbed the cover will have to be rolled back from the beds on bright sunny days from about nine in the morning until about five in the afternoon. If the cover is left over the bed during a hot, sunny day the plants may become scorched. After the plants become older the heat may be turned down and the cover left off to harden the plants before pulling for field setting, but danger of frost must be watched.

Storage—When the hotbed season is over a little attention given the beds can prove a big saving over a period of years. If a cloth cover is used, it can be made to last several seasons if it is dried out, rolled up, and stored away in a dry place. The potato bedding soil should be removed and the bed aired until ready for refilling the next season. Electricity should be cut off from the bed and the thermostat stored out of the weather in the case of the electric or hot water-heated beds.

REFERENCES CITED

1. Zahour, Robert L. Heating Hotbeds with Radiant Energy from Incandescent Lamp. Illuminating Engineering, Vol. XXXV, No. 7, July 1940.
2. Edmond, J. B., and Dunkelberg, G. H. Use of Electricity in Curing and Storing Sweet Potatoes. Fifty-third Annual Report, pages 39-47, South Carolina Experiment Station, Clemson, South Carolina.
3. Anderson, W. S. Sweet Potato Plant Production. Mississippi State College Agricultural Experiment Station Bul. 349, October 1940.
4. Edmond, J. B., and Dunkelberg, G. H. Additional Studies of Electricity in Sweet Potato Plant Production. Fifty-fourth Annual Report, South Carolina Experiment Station, Clemson, South Carolina.
5. Beattie, W. R. Hotbeds and Coldframes. U. S. Department of Agriculture Farmers Bul. 1743, 1935.

ACKNOWLEDGMENTS

The author wishes to acknowledge the valuable help of Mr. E. A. Hodge and Mr. Garland O. Edelen, of the Louisiana Power and Light Company, for assistance in collecting data on electrical hotbeds; Mr. F. B. Fields and Mr. J. P. Fields, of Fields Seed and Plant Company, for their cooperation in supplying data on hot-water beds; and Mr. John Cox of the Louisiana State University Agricultural Extension Division for his guidance in the horticultural phase as related to this work.

LOUISIANA BULLETIN No. 454 JUNE, 1951

Cotton Marketing Practices Of Growers And Buyers In Selected Local Markets In Louisiana

By Alex M. Hodgkins, James F. Hudson and Felix E. Stanley

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

TABLE OF CONTENTS

Page

INTRODUCTION 5
  Purpose of Study 5
  Source of Information 6

COTTON PRODUCTION 7

GROWER PRACTICES 9
  Source of Quality Information 9
  Source of Market Information 11
  Number of Buyers Interviewed Prior to Sale of Cotton 12
  Time and Place of Sale of Cotton 14
  Factors Determining Time of Sale of Cotton 16
  Basis of Sale of Cotton 17

BUYER PRACTICES 18
  Type of Buyer and Size of Operation 18
  Sources From Which Buyers Obtained Cotton 21
  Varieties of Cotton Purchased 22
  Basis on Which Cotton Quality Was Determined 23
  Use of the Smith-Doxey Classification by Buyers 24
  Market on Which Cotton Prices Were Based 25
  Weights Used in Settlement for Cotton Purchased 26
  Assembly of Cotton Into Even-running Lots 26
  Financing the Purchase of Cotton in the Local Market 27

SUMMARY AND CONCLUSIONS 28
  Grower Practices 28
  Buyer Practices 30
  Conclusions 31

LIST OF TABLES

Table Page

I. Number and Percentage of Producers Harvesting Specified Acreages of Cotton in Eight Louisiana Parishes, 1947-48 Season 8

II. Volume and Proportion of Cotton Produced, by Variety, in Eight Louisiana Parishes, 1947-48 Season 9

III. Primary Source of Cotton Quality Information for 182 Producers in Eight Louisiana Parishes, 1947-48 Season 10

IV. Primary Source of Cotton Market Information Used by Producers in Eight Louisiana Parishes, 1947-48 Season 12
V. Number and Proportion of Producers Receiving Bids From Specified Number of Buyers Before Selling Cotton, by Volume of Cotton Produced on 182 Farms in Eight Louisiana Parishes, 1947-48 Season 13
VI. Number and Percentage of Producers Selling Cotton at Specified Time and Place in Eight Louisiana Parishes, 1947-48 Season 14
VII. Number of Bales and Percentage of Cotton Sold at Specified Time and Place in Eight Louisiana Parishes, 1947-48 Season 15
VIII. Factors Determining Time of Sale of Cotton by Producers in Eight Louisiana Parishes, 1947-48 Season 16
IX. Number of Bales and Proportion of Cotton Sold by Producers for Specified Reasons in Eight Louisiana Parishes, 1947-48 Season 17
X. Basis of Sale of Cotton by Producers in Eight Louisiana Parishes, 1947-48 Season 18
XI. Number and Proportion of Buyers, Volume and Proportion of Cotton Bought, and Average Volume of Cotton Purchased, by Type of Buyers in Eight Louisiana Parishes, 1947-48 Season 19
XII. Size of Territories from Which Cotton was Bought by First Buyers in Eight Louisiana Parishes, 1947-48 Season 21
XIII. Volume and Proportion of Cotton Purchased From Specified Sources by Buyers in Eight Louisiana Parishes, 1947-48 Season 22
XIV. Volume and Proportion of Cotton Purchased by Variety by Local Buyers in Eight Louisiana Parishes, 1947-48 Season 23
XV. Basis for Determination of Cotton Quality by Local Buyers in Eight Louisiana Parishes, 1947-48 Season 24
XVI. Acceptance of the Smith-Doxey Cotton Classification by Local Buyers in Eight Louisiana Parishes, 1947-48 Season 25
XVII. Number and Percentage of Buyers Using Specified Market as a Base for Cotton Price Determination in Eight Louisiana Parishes, 1947-48 Season 26
XVIII. Volume and Proportion of Cotton Purchased on Specified Weights by Local Buyers in Eight Louisiana Parishes, 1947-48 Season 26
XIX. Number and Percentage of Local Buyers Assembling Cotton into Even-running Lots by Specified Factors of Quality in Eight Louisiana Parishes, 1947-48 Season 27

XX. Number and Proportion of Buyers Using Specified Source of Capital for Purchasing Cotton in Eight Louisiana Parishes, 1947-48 Season 28

FIGURE

1. Location of Parishes Included in the Study, by Cotton Grade and Staple Reporting Districts, Louisiana, 1947-48 Season 7

ACKNOWLEDGEMENTS

This study is the first phase of a regional cotton marketing project in which twelve cotton producing states, the Bureau of Agricultural Economics, the Bureau of Plant Industry, and the Production and Marketing Administration are cooperating. Similar studies have been made by all participating states and the combined results will be released as a regional publication. Funds for this study were made available under the Research and Marketing Act of 1946.

The authors wish to express their appreciation to Dr. B. M. Gile, Head, Department of Agricultural Economics, Louisiana State University, for his constructive criticism of the manuscript; to other cooperating states and agencies in the Regional Cotton Marketing Project for helpful ideas and comments; and to the cotton growers, ginners, and buyers for their cooperation in furnishing the data used in the study.

COTTON MARKETING PRACTICES OF GROWERS AND BUYERS IN SELECTED LOCAL MARKETS IN LOUISIANA

ALEX M. HODGKINS, JAMES F. HUDSON AND FELIX E. STANLEY
Department of Agricultural Economics, Louisiana Agricultural Experiment Station

INTRODUCTION

The average annual cash receipts of Louisiana farmers from cotton lint and cottonseed during the five-year period 1944 through 1948 was $81,843,000, or 40.5 per cent of the average cash receipts from all crops sold.[1] As a source of income to farmers, cotton is the most important crop produced in Louisiana. In addition to its primary importance as a source of income to farmers, cotton, because of its wide distribution within the state, directly affects the welfare of more farm people than any other Louisiana crop. Some cotton was planted on 61.3 per cent of the farms in the state in 1945, and was distributed among 56 of the 64 parishes.[2]

The local cotton market has long been considered the weakest phase of the cotton marketing system. Numerous studies in the late 1920's and early 1930's indicated that the premiums and discounts paid for the various qualities of cotton in central and spinners' markets were not fully reflected in the prices paid to growers in the local markets. This tendency towards an average price for all qualities of cotton in the local market has an adverse effect upon the quality of the cotton produced because it lessens the farmer's incentive to produce high quality cotton.

Purpose of the Study

The purposes of this study are: (1) to discover and describe the cotton marketing practices followed by growers and buyers in selected local markets in Louisiana, and (2) to compare the practices followed in the organized one-variety parishes to those followed in non-one-variety parishes.

The data were collected in Louisiana as part of the regional cotton marketing project. The information obtained is of importance in pointing out the marketing practices followed in the local markets in Louisiana and will be useful as background information for other studies of cotton marketing practices.

---

[1] United States Department of Agriculture, Bureau of Agricultural Economics, CASH RECEIPTS FROM FARMING BY STATES AND COMMODITIES, CALENDAR YEARS 1924-44, January 1946, and FARM INCOME SITUATION, May 1947, June-July 1948, and June 1949.

[2] United States Department of Commerce Bureau of the Census, UNITED STATES CENSUS OF AGRICULTURE, 1945, pp. 57-71.

Source of Information

Louisiana is divided geographically by the Cotton Branch, Production and Marketing Administration, United States Department of Agriculture, into four cotton grade and staple reporting districts. These districts broadly represent the four cotton producing areas of the state: District I, the Red River Delta Cotton Area; District II, the North Louisiana Upland Cotton Area; District III, the Mississippi River Delta Cotton Area; and District IV, the South Louisiana Cotton Area (Figure 1.) These geographic divisions were used as a basis in selecting the sample for this study.

The parishes in each of these districts were classified as "organized-one-variety" or "non-one-variety" parishes. Information on the number and location of one-variety parishes was obtained from the Louisiana Agricultural Extension Division. This list was composed of the parishes in which cotton growers had qualified for the Smith-Doxey services during 1947, and was submitted to the Extension Division by the government cotton classing offices at Alexandria and New Orleans, Louisiana.

All parishes in which farmers were not qualified to receive the Smith-Doxey services during 1947 were considered non-one-variety. This basis for classification imposes two limitations on the one-variety data obtained: (1) Only the parishes which had qualified for the Smith-Doxey services during 1947 were considered as one-variety parishes. Parishes which had qualified in previous years, even as late as 1946, were classified as non-one-variety. (2) Prior to 1947 there had been both Bureau of Plant Industry one-variety organizations and Smith-Doxey one-variety cotton improvement associations in Louisiana. Parishes which had never qualified for the Smith-Doxey services may have contained the Bureau of Plant Industry one-variety organizations prior to 1947. Although these organizations were inactive in 1947, it is unlikely that any effect they had on the production and marketing practices of their members would have disappeared completely by the time this study was made.

After classification, one organized and one unorganized parish was selected at random from each of the four districts.[3] The resultant sample consisted of eight parishes, four of which were organized and four unorganized for cotton improvement (Figure 1).

The cotton farmers to be interviewed were selected with the assistance of the ginners in each parish. Schedules were obtained from 182 farmers, 98 in organized and 84 in unorganized parishes. Where possible a schedule was obtained from each cotton buyer to whom the farmer interviewed had sold cotton in 1947. A total of 30 buyers, 16 in organized and 14 in unorganized parishes, were interviewed.

COTTON PRODUCTION

The average size of the cotton enterprise on the 182 farms

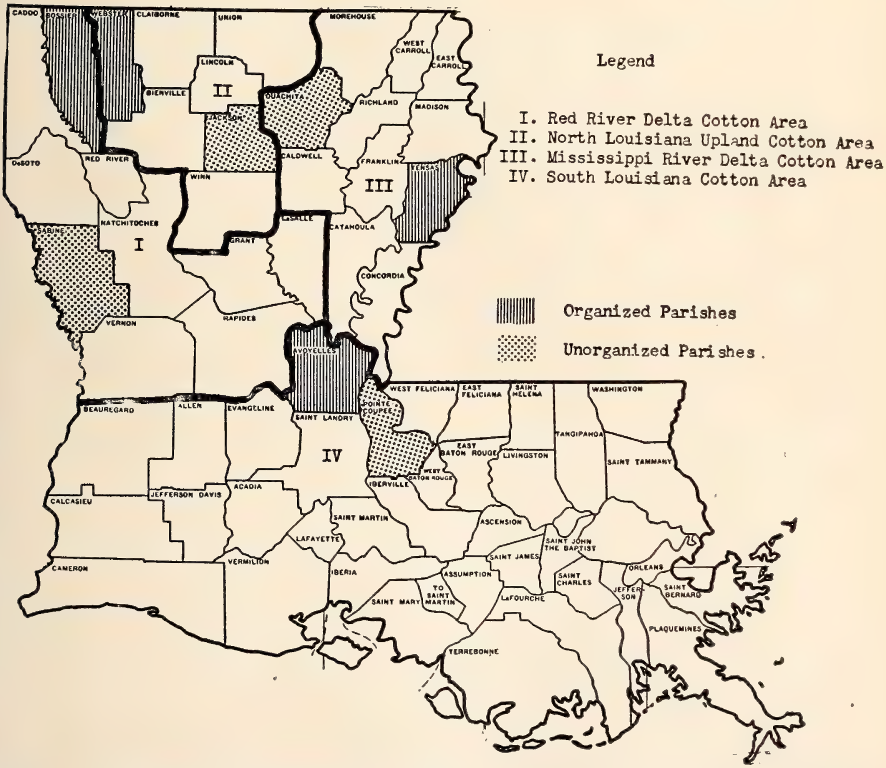


FIG 1.—Location of Parishes Included in the Study, by Cotton Grade and Staple Reporting Districts, Louisiana.

included in this study was 80.5 acres. The acreage was considerably larger in organized than in unorganized parishes, 118 compared to 37 acres per farm. About 67 per cent of the producers in the unorganized and 39 per cent in organized parishes harvested fewer than 20 acres of cotton. Conversely, 28.6 per cent of the producers in organized parishes compared to only 13 per cent in unorganized parishes harvested 100 or more acres of cotton (Table 1). About 10 per cent of the producers in organized parishes harvested a larger acreage of cotton than the 310 acres harvested by the largest producer in an unorganized parish. The average production was 100 bales per farm in organized and 29 bales per farm in unorganized parishes. The difference in the total volume of cotton ginned, 27,403 bales in unorganized and 64,707 bales in organized parishes, indicates the relative importance of cotton in the two groups of parishes studied.[4]

---

[3] Hereafter in this study, "one-variety parishes" and "non-one-variety parishes" will be synonymous to "organized parishes" and "unorganized parishes," respectively.

TABLE I.—Number and Percentage of Producers Harvesting Specified Acreages of Cotton in Eight Louisiana Parishes, 1947-48 Season

Acres in Cotton	Producers Harvesting Specified Acreage in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Less than 10*	20	20.4	34	40.5
10-19	18	18.3	22	26.2
20-49	13	13.3	12	14.3
50-99	19	19.4	5	6.0
100-199	13	13.3	8	9.5
200 and over**	15	15.3	3	3.5
Totals	98	100.0	84	100.0

*Lower limit of class: organized parishes—3 acres
unorganized parishes—1½ acres.

**Upper limit of class: organized parishes—1120 acres
unorganized parishes—310 acres.

Deltapine 14 was the adopted variety of producers in all organized parishes except Tensas. Coker 100 was the adopted variety of one community in the Northern portion of Tensas Parish, and accounts for the large proportion of this variety produced in organized parishes. Producers in the Southern part of Tensas Parish adopted Deltapine 14. Although two varieties of cotton were adopted by producers in Tensas Parish, the Smith-Doxey one-variety organization was parish-wide. The production of each variety was localized, and inter-planting was not practiced. The two adopted varieties, Deltapine 14 and Coker 100, accounted for more than 99 per cent of the production in organized parishes (Table II).

---

[4] United States Department of Commerce, Bureau of Census, Washington, D. C. COTTON GINNED IN LOUISIANA: CROPS OF 1948 AND 1947, March 22, 1949.

About 95 per cent of the cotton produced in unorganized parishes was Deltapine 14. Although the one-variety cotton improvement organizations may have been instrumental in establishing the one-variety concept among Louisiana farmers, in 1947 there was little difference in the varieties of cotton planted in organized and unorganized parishes.

TABLE II.—Volume and Proportion of Cotton Produced, by Variety, in Eight Louisiana Parishes, 1947-48 Season

Variety of Cotton	Production of Specified Variety of Cotton in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Deltapine 14	7,553	76.8	2,287	94.7
Coker 100	2,208	22.4	6	0.2
Stoneville*	36	0.4	112	4.6
Sure-crop	29	0.3	0	0
Half and Half	7	0.1	7	0.3
Rowden	0	0	4	0.2
Totals	9,833	100.0	2,416	100.0

*Includes 106 bales of Stoneville 2B and 42 bales of Stoneville 5A.

GROWER PRACTICES

Source of Quality Information

Since the price paid for an individual bale or lot of cotton in relationship to other cotton depends largely upon its quality, it is important for the producer to know the quality of his cotton when he is ready to sell. Of the 182 producers interviewed only 3 considered themselves capable of classing cotton accurately. In other words, the majority of the producers had to rely upon some source other than themselves for quality information. Buyer classification at the time of sale was the primary source of quality information, and there was little difference in the proportion of producers in organized and unorganized parishes who relied upon this source for quality information. Because the buyer is interested in buying the cotton as cheaply as possible, his classification may be biased, and therefore is of little value to the producer as a basis for bargaining.

Although the Smith-Doxey classification service is free, and has been available to qualified producers since 1938, it was used by only 12.2 per cent of the producers interviewed in organized parishes. However, the producers using the service sold more than 12 per cent of the cotton represented in organized parishes, which indicates that the Smith-Doxey classification service was used more extensively by large than by small volume producers. Although producers who are not members of cotton quality improvement organizations are not eligible to receive the Smith-Doxey services, approximately 5 per cent of the producers in unorganized parishes received quality information from this source. These producers received the classification by patronizing a gin or warehouse which had been designated as the sampling agent by an eligible group of producers.

While none of the producers in organized parishes sold their cotton without knowledge of its quality, approximately 8 per cent of those in unorganized parishes did not know the quality of their cotton when it was sold (Table III).

TABLE III.—Primary Source of Cotton Quality Information for 182 Producers in Eight Louisiana Parishes, 1947-48 Season

Source of Quality Information	Producers Using Specified Source of Quality Information in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Buyers' class*	82	83.7	70	83.3
Smith-Doxey class	12	12.2	4	4.8
Warehouseman's class	3	3.1	0	0
Producer's class	1	1.0	2	2.4
Ginner's class	0	0	1	1.2
Quality unknown to producer	0	0	7	8.3
Totals	98	100.0	84	100.0

*Includes classification by cooperative associations.

Source of Market Information

In addition to a knowledge of the quality of his cotton, a producer should know its market value when he is ready to sell. Whether or not a producer is well-informed as to market conditions depends upon his source of market information, the frequency of reference to the source, and his ability to adapt the information to his individual needs. Market price reports are based on Middling 15/16 inch cotton. The producer must be able to add or subtract the premiums or discounts which apply to the particular quality of cotton he has to sell. Of the sources of market information used by producers, the daily newspapers, radio broadcasts, and government price reports seem best suited to their purpose. One or more of these sources is regularly available to most farmers at nominal cost and effort. Information from other sources used by producers is likely to be sporadic and may be biased. Many of the larger brokers and cotton buyers have direct telegraph connections over which they receive market information periodically throughout the day. Information from this source is more timely than information from the other sources. However, market information from this source, the gin bulletin board, verbal information, and the price offer, require contact with the source by the producer each time market information is desired. As a result, the producer is likely to obtain information from these sources only at the time he gins or is ready to sell his cotton. Such information gives little indication of market trends and is of little value in helping the producer decide when to sell his cotton.

The daily newspaper, radio broadcast, or government price report was the primary source of market information for 76.5 per cent of the producers in organized and 67.9 per cent of those in unorganized parishes. The daily newspaper was the primary source of market information for 43.9 and 35.8 per cent, radio broadcasts for 21.4 and 25.0 per cent, and government price reports for 11.2 and 7.1 per cent of the producers in the organized and unorganized groups, respectively.

Approximately 10 per cent of the producers in organized and 26 per cent of those in unorganized parishes obtained market information from cotton factors and brokers. A small percentage of the producers in both groups obtained market information from the gin bulletin board, verbal information, or the price offer (Table IV).

TABLE IV.—Primary Source of Cotton Market Information Used by Producers in Eight Louisiana Parishes, 1947-48 Season

Primary Source of Market Information	Producers Using Specified Source of Market Information in: Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Daily newspaper	43	43.9	30	35.8
Radio broadcasts	21	21.4	21	25.0
Government price reports	11	11.2	6	7.1
Cotton factors & brokers	10	10.2	22	26.1
Gin bulletin board	5	5.1	1	1.2
Verbal Information*	4	4.1	3	3.6
Price offer	4	4.1	1	1.2
Totals	98	100.0	84	100.0

*Information from friends who had sold cotton or had obtained information from some other source.

Number of Buyers Interviewed Prior to Sale of Cotton

Cotton buyers generally receive a price basis at periodic intervals from various sources such as the firms they represent, firms to whom they sell, and other buyers. They use this basis and market price quotations in determining the prices offered for various qualities of cotton. Often a firm that must make delivery of a particular quality of cotton in the near future, raises its basis to buyers in the field in order to obtain the necessary cotton quickly. In such cases the producer who sells to one of these buyers is likely to get a higher price for his cotton than if he had sold to another buyer. The producer who obtains bids from several buyers prior to the sale of his cotton is more likely to find one who has a special demand for the particular quality of cotton he has to offer. This method of bargaining is effective where there is competition between buyers. However, in many of the markets surveyed only one buyer was available. As a rule, the producers who sold on these markets produced small volumes of cotton and considered the cost in time and money necessary to obtain more than one bid prohibitive. In these non-competitive markets it is especially important for producers to be well-informed of the quality of their cotton and of market conditions.

Approximately 70 per cent of the producers in unorganized and 36 per cent of those in organized parishes interviewed only one

TABLE V.—Number and Proportion of Producers Receiving Bids From Specified Number of Buyers Before Selling Cotton, by Volume of Cotton Produced on 182 Farms in Eight Louisiana Parishes, 1947-48 Season

Number of Buyers Interviewed	Number of Bales Produced					
	1-25	26-100	101-300	More than 300	Total	
	Producers					
	Number	Number	Number	Number	Number	Per cent
Organized Parishes:						
1	24	7	4	0	35	35.7
2	18	7	3	0	28	28.6
3 or more	13	6	6	4	29	29.6
Unknown*	0	0	3	3	6	6.1
Totals	55	20	16	7	98	100.0
Per cent receiving bid from only one buyer	43.5	35.0	25.0	0	35.7	
Unorganized Parishes:						
1	50	5	4	0	59	70.3
2	6	2	1	0	9	10.7
3 or more	11	2	2	1	16	19.0
Unknown*	0	0	0	0	0	0
Totals	67	9	7	1	84	100.0
Per cent receiving bid from only one buyer	74.6	55.6	57.1	0	70.3	

*Producers sold through brokers.

buyer before selling their cotton. The smaller producers tended to sell to the first bidder and, as the volume of production increased, the tendency to receive more than one bid prior to the sale of cotton increased. All of the producers having a volume of more than 300 bales received more than one bid prior to the sale of their cotton.

The difference in the proportion of producers in organized and in unorganized parishes who sold their cotton after a single bid was pronounced in every size group where the number of cases warrants comparison (Table V). The major reason for this was the smaller size of the cotton enterprise on farms and the smaller volume of cotton produced in unorganized than in organized parishes. In areas where the volume of cotton was too small to attract competitive buyers, producers sold to a particular buyer because no other buyer was available. This condition was more prevalent in unorganized than in organized parishes. Forty-four per cent of the producers in unorganized and 12.2 per cent of those in organized parishes gave "no other buyer available" as their reason for choice of buyer.

Time and Place of Sale of Cotton

Approximately 90 per cent of the producers in unorganized

TABLE VI.—Number and Percentage of Producers Selling Cotton at Specified Time and Place in Eight Louisiana Parishes, 1947-48 Season

Place of Sale	Producers Selling Cotton at Specified Place			
	On the Date Ginned		On a Later Date	
	Number	Per cent	Number	Per cent
Organized Parishes:				
Gin or street market	42	42.9	2	2.0
Local cotton yard or warehouse	2	2.0	4	4.1
Farm	0	0	1	1.0
Cotton buyer's office	34	34.7	13	13.3
Total producers selling	78	79.6	20	20.4
Unorganized Parishes:				
Gin or street market	48	57.2	2	2.4
Local cotton yard or warehouse	7	8.3	1	1.2
Farm	0	0	3	3.5
Cotton buyer's office	21	25.0	2	2.4
Total producers selling	76	90.5	8	9.5

parishes and 80 per cent of those in organized parishes sold their cotton the same day it was ginned (Table VI).

The proportion of producers who sold their cotton on the same day it was ginned was larger than the proportion of cotton sold at this time. This indicated a tendency for small volume producers to sell cotton immediately after it was ginned. The immediate sale of cotton by small volume producers was more evident in organized than in unorganized parishes (Tables VI and VII). In organized parishes 80 per cent of the producers sold 33 per cent of the total volume of cotton represented immediately after ginning. Ninety per cent of the producers in unorganized parishes sold 79 per cent of the total cotton immediately after ginning. This was due in part to the smaller and more uniform size of the cotton enterprise in unorganized than in organized parishes.

TABLE VII.—Number of Bales and Percentage of Cotton Sold at Specified Time and Place in Eight Louisiana Parishes, 1947-48 Season

Place of Sale	Cotton Sold at Specified Place			
	On the Date Ginned		On a Later Date	
	Bales	Per cent	Bales	Per cent
Organized Parishes:				
Gin or street market	1,126	11.5	637	6.5
Local cotton yard or warehouse	11	0.1	1,301	13.2
Farm	0	0	10	0.1
Cotton buyer's office	2,116	21.5	4,632	47.1
Total sales	3,253	33.1	6,580	66.9
Unorganized Parishes:				
Gin or street market	745	30.8	9	0.4
Local cotton yard or warehouse	260	10.8	14	0.6
Farm	0	0	136	5.6
Cotton buyer's office	903	37.4	349	14.4
Total sales	1,908	79.0	508	21.0

From the standpoint of the proportion of producers using it, the gin or street market was the most important place of sale. About 60 per cent of the producers in unorganized parishes and 45 per cent in organized parishes used this place of sale.

Although a majority of the producers sold their cotton at the gin or street market, their sales accounted for a small proportion of the total cotton sold. Eighteen per cent of the cotton in organized and about 31 per cent of that in unorganized parishes was sold at the gin or street market (Table VII).

From the standpoint of volume of cotton sold, the cotton buyers' office was the important place of sale. About 68 per cent of the cotton in organized parishes and 52 per cent in unorganized parishes was sold at the buyers' office.

Although more producers sold their cotton immediately after ginning and at the gin or street market, the sale of cotton at a later date and at the cotton buyers' offices was more important from a volume of sales standpoint.

Factors Determining Time of Sale of Cotton

The three most important reasons for the time of sale of cotton by the producers interviewed were: (1) custom to sell immediately, (2) price considered to be most favorable, and (3) to meet immediate obligations. There was little difference in the proportion of producers in organized and unorganized parishes to whom "custom to sell immediately" was the deciding factor in time of sale. About 30 per cent of the producers in organized and 18 per cent of those in unorganized parishes sold their cotton when they considered the price most favorable. The proportion of producers who sold to meet immediate obligations was smaller, 11.2 per cent compared to 20.2 per cent, in organized than in unorganized parishes (Table VIII).

TABLE VIII.—Factors Determining Time of Sale of Cotton by Producers in Eight Louisiana Parishes, 1947-48 Season

Reason for Sale of Cotton	Producers Selling Cotton for Specified Reasons in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Custom to sell immediately	55	56.1	48	57.1
Price considered most favorable	29	29.6	15	17.9
To meet immediate obligations	11	11.2	17	20.2
Convenience	1	1.0	3	3.6
To avoid storage, insurance, and other charges	2	2.1	1	1.2
Total	98	100.0	84	100.0

Small volume producers tended to sell because of "custom" or "to meet immediate obligations" while large producers sold when they considered the price most favorable. Although only a small percentage of the producers in both groups sold their cotton when they considered the price most favorable, they sold a large proportion of the total volume of cotton (Tables VIII and IX).

TABLE IX.—Number of Bales and Proportion of Cotton Sold by Producers for Specified Reasons in Eight Louisiana Parishes, 1947-48 Season

Reason for Sale of Cotton	Cotton Sold for Specified Reason in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Custom to sell immediately	4,594	46.7	1,104	45.7
Price considered most favorable	4,707	47.9	994	41.2
To meet immediate obligations	435	4.4	308	12.7
Convenience	74	0.8	9	0.4
To avoid storage, insurance, and other charges	23	0.2	1	*
Total	9,833	100.0	2,416	100.0

*Less than 0.1 per cent.

In most cases the producers who sold their cotton immediately after ginning because of "custom" believed that in the long run the price was most favorable at this time. These producers believed that over a period of years the price received for cotton becomes progressively lower as the harvesting season advances. Another factor which influenced producers to sell their cotton immediately was that they felt the inconvenience and added expense involved in the storage of cotton tended to offset any increase in price they might obtain by holding it until a later date.

Basis of Sale of Cotton

Most of the cotton sales by producers were based on samples from the bales of cotton to be sold. The grade and staple length as determined from these samples was the basis for determining the price of the majority of the cotton represented in this study. The price paid for all cotton in organized and about 78 per cent of that in unorganized parishes was determined by this method.

About 16 per cent of the cotton in unorganized parishes was sold on hog-round basis. Hog-round buying is unsatisfactory from the standpoint of producers of high quality cotton since they do not receive premiums for this cotton. Hog-round buyers are familiar with the area in which they buy cotton, and can approximate closely the average value of the cotton in the market at a given time. Although this practice is suitable to them, it penalizes the producer whose cotton is higher in quality than the average for the community, and subsidizes the producer of low quality cotton. Under such marketing conditions, the producer has little incentive to produce high quality cotton.

The price of approximatly 6 per cent of the cotton sold in unorganized parishes was determined on the basis of grade only (Table X).

TABLE X.—Basis of Sale of Cotton by Producers in Eight Louisiana Parishes, 1947-48 Season

Basis of Sale	Cotton Sold on Specified Basis in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Sample Classification:				
Grade and staple	9,833	100.0	1,877	77.7
Grade only	0	.0	142	5.9
Hog-round	0	.0	389	16.1
Seed cotton*	0	.0	8	0.3
Total	9,833	100.0	2,416	100.0

*Does not include remnants.

BUYER PRACTICES

The local buyer is the first step in the movement of cotton from the producers to the cotton mills. His function in the marketing system is to begin the assembly of cotton from numerous producers into lots large enough for efficient handling by larger cotton merchants, or for segregation into even-running quality lots for sale direct to the mills. The efficiency with which this function is performed affects the entire marketing system and the cost of marketing cotton.

Type of Buyer and Size of Operation

About 31 per cent of the buyers in organized parishes and 57 per cent in unorganized parishes were independent ginner-buyers, 31 and 14 per cent, respectively, were shipper-buyers, 25 and 7 per cent, respectively, were commission buyers, and 12 per cent in

TABLE XI.—Number and Proportion of Buyers, Volume and Proportion of Cotton Bought, and Average Volume of Cotton Purchased, by Type of Buyer in Eight Louisiana Parishes, 1947-48 Season

Type of Buyer	Buyers		Cotton Bought		Average per Buyer
	Number	Per cent	Bales	Per cent	Bales
Organized Parishes:					
Independent ginner-buyer	5	31.3	4,550	3.9	910
Independent buyer	2	12.4	900	0.8	450
Shipper-buyer	5	31.3	69,300	58.6	13,860
Commission buyer	4	25.0	43,400	36.7	10,850
Total	16	100.0	118,150	100.0	7,384
Unorganized Parishes:					
Independent ginner-buyer	8	57.1	6,033	22.3	754
Independent buyer	3	21.5	531	2.0	177
Shipper-buyer	2	14.3	17,500	64.6	8,750
Commission buyer	1	7.1	3,000	11.1	3,000
Total	14	100.0	27,064	100.0	1,933

organized and 22 per cent in unorganized parishes were independent buyers. The buyers in organized parishes purchased 118,150 bales of cotton during the 1947-48 season, or an average of 7,384 bales per buyer. Independent ginner-buyers purchased approximately 4 per cent of the cotton, shipper-buyers 59 per cent, commission buyers 37 per cent, and independent buyers less than 1 per cent The buyers in unorganized parishes purchased 27,064 bales of cotton during the 1947-48 season, or an average of 1,933 bales per buyer. Independent ginner-buyers purchased approximately 22 per cent of the cotton, shipper-buyers 65 per cent, commission buyers 11 per cent and independent buyers 2 per cent (Table XI).

The hierarchy of local cotton buyers in this study was more or less well defined. At the beginning, in direct contact with the producer and usually buying cotton from him only, were the independent and independent ginner-buyers. Commission and shipper-buyers usually were located in the larger local markets, and bought cotton from producers and other buyers. In view of this the inverse relationship between the proportion of buyers and the proportion of cotton bought by each type is understandable. Independent buyers bought the smallest average volume of cotton, followed by independent ginner-buyers, commission buyers, and shipper-buyers in ascending order by volume purchased.

The difference in the composition of local buyer types in organized and unorganized parishes reflects the difference in the volume of cotton traded in the two groups of parishes. About 56 per cent of the buyers in organized compared to 21 per cent of those in unorganized parishes were shipper or commission buyers. A larger proportion of commission and shipper-buyers is to be expected in large volume trade areas because both depend upon their ability to purchase a large volume of cotton for the success of their operations. The shipper-buyer must have a large volume available in order to meet the demands of his clients for specific qualities of cotton. The commission buyer receives a specified commission per bale of cotton bought, and is also directly affected by the volume of cotton he is able to buy. The volume of cotton bought by independent and independent ginner-buyers also affects their operations, but usually they buy cotton in addition to other activities, so are not as dependent upon the volume of cotton they are able to buy.

There was little difference in the size of buyers' territories in organized and unorganized parishes, both having a wide range in the radius of the territories in which the buyers purchased cotton

(Table XII). However, the estimated average volume of cotton traded in the buyers' territories was larger in organized than in unorganized parishes. Five, or 35.7 per cent, of the buyers in unorganized parishes operated in territories in which they estimated the total volume of cotton traded at less than 1,000 bales. In no case did a buyer in organized parishes estimate the volume traded in his territory at less than 1,000 bales. The largest volume traded in a territory in unorganized parishes was 30,000 bales. Four, or 25 per cent, of the buyers in organized parishes operated in territories where the estimated volume was larger than the 30,000-bale maximum in a territory in unorganized parishes. The largest estimated volume traded in a territory in organized parishes was 150,000 bales.

TABLE XII.—Size of Territories From which Cotton was Bought by First Buyers in Eight Louisiana Parishes, 1947-48 Season

Radius in Miles	Buyers Purchasing Cotton Within Specified Radii in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
20 or less	7	43.7	7	50.0
21 - 40	4	25.0	4	28.6
41 - 60	3	18.7	2	14.3
61 - 80	1	6.3	0	.0
More than 80	1	6.3	1	7.1
Total	16	100.0	14	100.0

Sources From Which Buyers Obtained Cotton

Approximately 77 per cent of the cotton in organized parishes and 91 per cent in unorganized parishes was purchased directly from the producer. About 23 per cent of the cotton purchased by buyers in organized parishes and 9 per cent of that purchased by buyers in unorganized parishes was from sources other than the producer (Table XIII). The larger volume of buyer-to-buyer trading in organized parishes again indicates the difference in volume of cotton traded in the markets in organized and unorganized parishes. The buyers in the larger markets, most of which were located in organized parishes, were the sales outlet for the small volume cotton buyers in the outlying production areas. In addition, buyers in large volume markets who specialize in supplying specific qualities of cotton often find it impossible to meet the demand through purchases from producers alone. In these cases, buyers trade among themselves in addition to buying from producers.

TABLE XIII.—Volume and Proportion of Cotton Purchased From Specified Sources by Buyers in Eight Louisiana Parishes, 1947-48 Season

Source of Supply of Cotton	Cotton Purchased From Specified Source in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Cotton producers	90,470	76.6	24,714	91.3
Cotton factors	19,000	16.1	0	.0
Cotton ginners	5,700	4.8	0	.0
Other buyers	2,980	2.5	2,350	8.7
Total	118,150	100.0	27,064	100.0

Varieties of Cotton Purchased

Estimates of the varieties of cotton purchased by the buyer interviewed probably are not as accurate nor as representative of the area studied as similar data collected from producers. The territorie in which the buyers operated frequently were larger than those covered by the estimates of producers, so their knowledge of specific details is likely to have been less accurate. Some buyers' estimates were not representative of the area studied because their operation were not confined to the parish in which these operations were based.

Buyers estimated that 89 per cent of the cotton purchased in organized parishes and 79 per cent in unorganized parishes was Deltapine 14 (Table XIV). Half and Half comprised 3.8 per cent of the total cotton purchased in organized parishes, in which producers reported that only 0.1 per cent of the cotton ginned was Half and Half. The production of Half and Half cotton in Louisiana is almost entirely in the North Louisiana Upland Cotton Area. Even in this area, production is so scattered that it is difficult to find a buye who has a demand for it. As a result, most of it moves into Shreveport-Bossier City market, the nearest large volume ma to the area in which it is produced. About 93 per cent of the Half a Half was purchased by buyers in Bossier Parish, and 63.5 per was bought by a single buyer. This accounts for the large proport of the variety purchased by buyers located in organized parishes.

The purchase of Coker 100 and Delfos also was localized. Approximately 90 per cent of the Coker 100 was bought by a single buyer in Tensas Parish, where it was the adopted variety of one cotton improvement organization. Similarly, 83.2 per cent of the Delfos was purchased by one buyer in Tensas Parish. The purchase of Stoneville 2B was more scattered. Nine buyers, eight in unorganized and one in organized parishes, bought some Stoneville 2B.

TABLE XIV.—Volume and Proportion of Cotton Purchased, by Variety, by Local Buyers in Eight Louisiana Parishes, 1947-48 Season

Variety Purchased	Cotton Purchased by Buyers Located in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Deltapine 14	105,333	89.1	21,485	79.4
Half and Half	4,512	3.8	210	0.8
Stoneville 2B	300	0.3	4,190	15.5
Coker 100	3,860	3.3	345	1.3
Delfos	2,260	1.9	24	0.1
Stoneville 5A	895	0.8	390	1.4
Rowden	0	.0	420	1.5
Other	990	0.8	0	.0
Total	118,150	100.0	27,064	100.0

Basis on Which Cotton Quality Was Determined

The methods used to determine the quality of cotton varied between buyers. The grade and staple length of the cotton were the two factors of quality upon which 94 per cent of the buyers in organized parishes and 64 per cent in unorganized parishes based their price offer. Only a small percentage of the buyers said that the character and variety of the cotton were considered in determining their price offer. None of the buyers located in organized parishes reported buying cotton on a hog-round basis. Three, or 21.4 per cent of the buyers in unorganized parishes bought 8.3 per cent of the total on purchased on this basis (Table XV). These three buyers were so ginners.

It is a well known fact among cotton classers that a frequent ference to grade standards and staple types is a necessary check

TABLE XV.—Basis for Determination of Cotton Quality by Local Buyers in Eight Louisiana Parishes, 1947-48 Season

Basis for Quality Determination	Buyers Determining Cotton Quality on Specified Basis in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Grade and staple	15	93.8	9	64.3
Grade, staple, character and variety	1	6.2	2	14.3
Hog-round	0	.0	3	21.4
Total	16	100.0	14	100.0

on a classer's accuracy. Under the best of conditions, cotton classing is inexact to a certain degree. Without standards of some kind against which frequent checks can be made, any classes into which the classer places the cotton necessarily must be broad. Although a majority of the buyers in both groups said their price offer was based, in part at least, on the grade and staple length of the cotton, only one-half the buyers in organized and 28.6 per cent of those in unorganized parishes had access to official grade standards and staple types. It should be pointed out, however, that some cotton firms supply their buyers with type samples of the various qualities of cotton they need. These type samples, although unofficial, frequently are more exacting than the official standards and staple types. The extent of this practice was not determined.

Use of the Smith-Doxey Classification by Buyers

The attitude of buyers toward the Smith-Doxey classification of cotton varied from outright hostility to unequivocal support of the program. Approximately 19 per cent of the buyers in organized parishes and 29 per cent in unorganized parishes said they were willing to purchase cotton on the Smith-Doxey classification. Sixty-nine and 50 per cent of the buyers in the two groups, respectively, were definite in their unwillingness to buy cotton on this classification. The remaining buyers in both groups were not familiar enough with the service to have formed an opinion one way or the other. Therefore, at the time it was given, their answer amounted to an unwillingness to accept the classification as a basis for the purchase of cotton (Table XVI).

Many of the buyers who said they were unwilling to buy cotton on the Smith-Doxey classification approved the service, but could

TABLE XVI.—Acceptance of the Smith-Doxey Cotton Classification by Local Buyers in Eight Louisiana Parishes, 1947-48 Season

Willing to Buy Cotton on Smith-Doxey Classification	Buyers' Reaction to Smith-Doxey Classification in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Yes	3	18.8	4	28.6
No	11	68.7	7	50.0
Uncertain*	2	12.5	3	21.4
Total	16	100.0	14	100.0

*Buyers who were not familiar with the classification service did not know whether or not they would be willing to accept it.

not use it as a basis for buying cotton because they could not sell on it. One explanation for the lack of wide acceptance of the classification by cotton firms and buyers was that the official grades for cotton, which are used in the Smith-Doxey classification, are too broad. Some cotton firms designate as many as four qualities of cotton which fall within a single official standard for grade. There are price differentials between these commercial grades, and competition prevents buyers from accepting the Smith-Doxey grades. This would, in effect, mean paying an average price for the commercial grades which fall within a given official grade. Such a practice would attract the lower qualities within the official grade, while the higher qualities would be sold to competitors who recognized the difference in quality and based their prices accordingly.

A few buyers based their objections to the classification upon the alleged incompetence of the Smith-Doxey classers. These buyers usually were openly hostile to the service, and had evidence of glaring errors which had been made by classers. Buyers less hostile to the service admitted that the Smith-Doxey classers occasionally made mistakes, but, so far as they could tell, made no more frequent nor worse mistakes than is to be expected of any cotton classer.

Market on Which Cotton Prices Were Based

About 94 per cent of the buyers in organized parishes and 79 per cent in unorganized parishes used New York Futures Market quotations as the base in cotton price determination (Table XVII). The principal reason for using New York Futures prices was the activity of the market. Because of the large volume of trading the New York market tends to reflect price changes more quickly than any other market.

Two buyers, one each in organized and unorganized parishes, reported basing their prices on the nearest central market prices. Two buyers, both ginner-buyers, and both in the same unorganized parish, reported having no definite market upon which their prices were based. Both buyers sold to other local buyers, who kept them informed of price changes.

TABLE XVII.—Number and Percentage of Buyers Using Specified Market as a Base for Cotton Price Determination in Eight Louisiana Parishes, 1947-48 Season

Base Market	Buyers Using Specified Base for Determining Price in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
New York futures	15	93.8	11	78.6
Nearest central market	1	6.2	1	7.1
No definite base	0	.0	2	14.3
Total	16	100.0	14	100.0

Weights Used in Settlement for Cotton Purchased

Cotton weights upon which settlement with the seller was based were determined either by a licensed weigher at a public warehouse or by the ginner. Warehouse weights were used in settlement for 79 per cent of the cotton purchased in organized parishes and for 76 per cent in unorganized parishes. Final settlement for the remaining cotton represented in both groups was on gin weights, none of which were guaranteed (Table XVIII).

TABLE XVIII.—Volume and Proportion of Cotton Purchased on Specified Weights by Local Buyers in Eight Louisiana Parishes, 1947-48 Season

Weights Determined by	Cotton Purchased on Specified Weights in			
	Organized Parishes		Unorganized Parishes	
	Bales	Per cent	Bales	Per cent
Ginner	24,610	20.8	6,564	24.3
Licensed weigher at warehouse	93,540	79.2	20,500	75.7
Total	118,150	100.0	27,064	100.0

Assembly of Cotton into Even-Running Lots

One function of the cotton marketing system is to collect cotton of various qualities from producers and deliver it to the mills at the time and in the quantities and qualities needed. Mills demand cotton of uniform quality. Somewhere in the marketing system cotton must be assembled into even-running lots of the various qualities preparatory to its delivery to the mills. Because the 100 bale lot usually is the unit of trade, most local buyers do not have sufficient volume to enable them to practice the assembly of cotton into uniform quality lots. However, local buyers whose volume is sufficiently large frequently are able to improve their bargaining position by selling cotton in uniform lots. In assembling the cotton, they perform more of the necessary marketing services and widen their range of prospective market outlets. The result is that these buyers usually obtain higher prices for their cotton. About 38 per cent of the buyers in organized and 28.5 per cent of those in unorganized parishes assembled their cotton into even-running lots. As might be expected, this practice was followed by the large volume buyers only. The grade and staple length of the cotton were the two factors of quality considered in the assembly of cotton. Other factors considered by some buyers, in addition to grade and staple length, were the production area and variety (Table XIX).

TABLE XIX.—Number and Percentage of Local Buyers Assembling Cotton into Even-Running Lots, by Specified Factors of Quality, in Eight Louisiana Parishes, 1947-48 Season

Basis of Assembly	Buyers Using Specified Factors for Assembly of Cotton in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Grade and staple length	3	18.8	1	7.1
Grade, staple and production area	0	.0	3	21.4
Grade, staple and variety	2	12.5	0	.0
Grade, staple, production area, and variety	1	6.2	0	.0
No assembly	10	62.5	10	71.5
Total	16	100.0	14	100.0

Financing the Purchase of Cotton in the Local Market

A large proportion of the cotton in local markets is bought with borrowed capital. The two major reasons for this are: (1) the purchase of cotton in large volume requires more capital than the buyer is able to supply, and (2) the demand for capital for buying cotton is seasonal. A cotton buyer, even if he had sufficient capital to finance his operations, could ill afford to keep the capital required available for seasonal use. If the volume of cotton bought is large, it is usually more economical to borrow the necessary capital when it is needed.

Approximately 31 per cent of the buyers in organized and 64 per cent of those in unorganized parishes used personal funds with which to buy cotton (Table XX). The larger proportion of buyers in unorganized then in organized parishes who used personal funds probably was the result of the larger proportion of small volume buyers in unorganized parishes. The volume of capital required to purchase cotton is directly proportional to the volume of cotton purchased. Therefore, small volume buyers more often than large volume buyers are able to finance their purchases from personal funds.

TABLE XX.—Number and Proportion of Buyers Using Specified Source of Capital for Purchasing Cotton in Eight Louisiana Parishes, 1947-48 Season

Source of Capital	Buyers Using Specified Source of Capital in			
	Organized Parishes		Unorganized Parishes	
	Number	Per cent	Number	Per cent
Personal funds	5	31.3	9	64.3
Local banks	5	31.3	3	21.4
Central market cotton merchants	5	31.3	2	14.3
Oil mills	1	6.1	0	.0
Total	16	100.0	14	100.0

Approximately 69 per cent of the buyers in organized and 36 per cent of those in unorganized parishes used borrowed capital to buy cotton. The proportion of cotton purchased by those buyers using borrowed capital was considerably larger than that purchased by buyers using personal funds.

SUMMARY AND CONCLUSIONS

Grower Practices

The average size of the cotton enterprise on the farms studied was 80.5 acres. The organized parishes were better adapted to cotton production than the unorganized parishes. The average size of the cotton enterprise in organized parishes was 118 acres, compared to 37 acres per farm in unorganized parishes. The total cotton produced was 67,707 bales in organized and 27,403 bales in unorganized parishes. As a result of the larger volume of cotton produced, marketing facilities were more highly developed in organized than in unorganized parishes.

In organized parishes, Deltapine 14 and Coker 100 were the two varieties adopted by the one-variety organizations, and accounted for more than 99 per cent of the cotton represented in this study. In unorganized parishes, about 95 per cent of the cotton produced was Deltapine 14.

All of the cotton in organized and 78 per cent of that in unorganized parishes was sold on the basis of its grade and staple length. Six per cent of the cotton in unorganized parishes was sold on the basis of grade only, and 16 per cent was sold on a hog-round basis.

The major difference in the source of quality information used by producers in organized and unorganized parishes was that 12.2 per cent of the producers in organized compared to 4.8 per cent in unorganized parishes obtained the Smith-Doxey classification for their cotton. All of the producers in organized, compared to 91.7 per cent in unorganized, parishes had information as to the quality of their cotton prior to its sale.

Approximately 70 per cent of the producers in unorganized and 36 per cent of those in organized parishes interviewed only one buyer before selling their cotton. There was a tendency for large producers to obtain bids from a larger number of buyers before making a sale than did small producers. The proportion of producers who sold after receiving only one price offer was greater in every size group in unorganized than in organized parishes. The fact that 44 per cent of the producers in unorganized compared to 12.2 per cent in organized parishes sold to a particular buyer because no other buyer was available reflects the difference in the markets in the two groups of parishes.

Approximately 90 per cent of the producers in unorganized parishes and 80 per cent of those in organized parishes sold their cotton the same day it was ginned. The proportion of producers who sold their cotton the same day it was ginned, and who used gin or street markets as the place of sale, was larger in unorganized than in organized parishes. Since there was a tendency for small volume producers to follow these practices, the larger proportion of producers in unorganized parishes who followed them probably was due to the larger proportion of small producers in these parishes, and to the less well developed markets.

Large producers tended to sell their cotton when they considered the price most favorable and small producers tended to sell immediately after ginning because of "custom" and to meet immediate obligations. "Custom to sell immediately" was the deciding factor in time of sale for 56.1 per cent of the producers in organized and 57.1 per cent in unorganized parishes. About 30 per cent of the producers in organized parishes sold their cotton when they considered the price most favorable, and 11.2 per cent sold to meet immediate obligations. In unorganized parishes, 18 per cent of the producers sold when they considered the price most favorable, and 20.2 per cent sold to meet immediate obligations.

Buyer Practices

Shipper-buyers and commission buyers were the two most prominent types of buyers in organized parishes, while independent ginner-buyers and independent buyers were the most prominent in unorganized parishes. From the standpoint of volume of purchases, shipper-buyers were the most important outlet in both groups, followed by commission buyers in organized parishes and independent ginner-buyers in unorganized parishes. The difference in the composition of local buyer types in organized and unorganized parishes reflects the difference in the volume of cotton traded in the two groups of parishes.

The grade and staple length of the cotton were the two factors of quality upon which 94 per cent of buyers in organized parishes and 64 per cent in unorganized parishes based their price offer. None of the buyers in organized parishes reported buying cotton on a hog-round basis, as compared to 21.4 per cent of the buyers in unorganized parishes who reported purchasing cotton on this basis. Although a majority of the buyers in both groups said their price offer was based, in part at least, on the grade and staple length of the cotton, only one-half the buyers in organized and 28.6 per cent of those in unorganized parishes had access to official grade standards and staple types.

Approximately three-fourths of the buyers in both groups were unwilling to buy cotton on the Smith-Doxey classification. Two major reasons for this were (1) the cotton could not be re-sold on the same classification, and (2) the range in quality included in each official standard for grade was too wide.

About 94 per cent of the buyers in organized parishes and 79 per cent in unorganized parishes used New York Cotton Futures Market quotations as the base in cotton price determination. The other buyers based their prices on the nearest central market, or depended upon other local buyers to supply the price basis. The weight upon which buyers settled with the sellers was determined by licensed warehouse weighers for 79 per cent of the cotton purchased in organized parishes and 76 per cent in unorganized parishes. Final settlement for the remaining cotton represented in both groups was on gin weights, none of which were guaranteed.

Approximately 38 per cent of the buyers in organized and 28.5 per cent of those in unorganized parishes assembled their purchases into even-running lots according to grade and staple length before reselling. Since this practice was followed by the large volume buyers only, a larger proportion of the cotton in organized parishes than in unorganized parishes was assembled into even-running lots before resale.

Conclusions

1. The organized parishes included in this study were located in areas better adapted to large-scale cotton production, produced a larger aggregate volume of cotton, and contained a higher proportion of large-scale cotton producers than the unorganized parishes. The larger volume of cotton produced in the organized parishes resulted in more highly developed marketing facilities than were found in the unorganized.

2. Marketing practices followed by farmers varied with the amount of cotton produced and the markets available. Large-volume producers follow better marketing practices than small producers. The higher proportion of large-scale cotton producers in organized parishes resulted in a greater proportion of producers in these parishes following the more desirable marketing practices.

3. The larger proportion of producers in organized parishes who had adequate information concerning cotton prices prior to the sale of their cotton was due in part to the use of official price reports made available to them under terms of the Smith-Doxey Act. Further development in the use of market news information would improve the producers' bargaining position in the sale of their cotton.

4. The free classification of cotton for growers in organized

parishes under the terms of the Smith-Doxey Act has been responsible in part for the larger proportion of producers in these parishes having knowledge of the quality of their cotton before sale. Expansion of participation in the Smith-Doxey program would increase the number of farmers who know what quality of cotton they are producing and would also tend to further improve the quality of cotton produced in Louisiana.

5. There is need for further educational work, especially among the smaller producers, with respect to the benefits to be derived from the use of the services made available under the Smith-Doxey Act and the means of applying these services as marketing aids.

E56

LOUISIANA BULLETIN NO. 455 JUNE, 1951

Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1949

By

HENRY J. CASSO, MORRIS M. LINDSEY, AND J. NORMAN EFFERSON

SURPLUS
TO REQUIREMENTS AS
[illegible]
NMSU LIBRARY
LAS CRUCES

LIBRARY
MAR 21 1966
NEW MEXICO STATE
UNIVERSITY

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

TABLE OF CONTENTS

Page

INTRODUCTION 5

PROCEDURE 6

COSTS AND RETURNS, 1938-49 7
- Volume of Business 7
- Costs and Returns per Farm 9
- Costs and Returns per Acre of Sugar Cane 11
- Costs and Returns per Ton 11
- Returns per Hour of Labor 12
- Average Costs and Returns for the 12-Year Period 1938-49 13

ORGANIZATION AND OPERATION OF FAMILY-TYPE SUGAR CANE FARMS 15
- Tenure 15
- Capital Investment 15
- Workstock Use and Costs 16
- Tractor, Truck, and Auto Use and Costs 16
- Man Labor 18

FACTORS AFFECTING NET RETURNS ON FAMILY-TYPE FARMS IN THE LOUISIANA SUGAR CANE AREA 19
- Size of Farm 21
- Yield per Acre 22
- Diversification of Enterprises 23
- Efficiency in the Use of Labor 24

SUMMARY 24

APPENDIX 27

LIST OF TABLES

TABLE Page

1. Number and Size of Family-Type Sugar Cane Farms Surveyed in the Louisiana Sugar Cane Area, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 8
2. Costs and Returns from Producing Sugar Cane on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 9
3. Costs and Returns for Family Farms in the Louisiana Sugar Cane Area for the 12-Year Period 1938-49 13

APPENDIX TABLES

TABLE Page

I. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, Annual 1946, 1947, 1948 and 1949 27

II. Costs and Returns per Acre of Cane Grown on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 28

III. Costs and Returns per Ton of Cane Sold for Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 29

IV. Average Labor Returns to the Operator from the Sugar Cane Enterprise for Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 29

V. Tenure of Farm Operators Surveyed, Family-Type Louisiana Sugar Cane Farms, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949 30

VI. Distribution of Capital Investment on Family-Type Sugar Cane Farms in Louisiana 30

VII. Costs of Mule Work on Louisiana Family-Type Sugar Cane Farms, Selected Years, 1938-1949 31

VIII. Cost of Tractor Work on Family-Type Sugar Cane Farms in Louisiana, 1948-49 31

IX. Costs of Operating Farm Trucks on Family-Type Sugar Cane Farms in Louisiana, 1948-1949 32

X. Costs of Operating Farm Automobiles on Family-Type Sugar Cane Farms in Louisiana, 1948-49 32

XI. Volume and Cost of Man Labor on 500 Family-Type Sugar Cane Farms, 1949 33

XII. Relation of Size of Farm to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49 33

XIII. Variation in Yield per Acre, 500 Family-Type Sugar Cane Farms, 1949 34

XIV. Relation of Yield per Acre of Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49 34

XV. Relation of Proportion of Cropland in Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49 35

Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1949

By

HENRY J. CASSO, MORRIS M. LINDSEY, AND J. NORMAN EFFERSON

INTRODUCTION

Detailed farm management and cost studies of the operation of family-type sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station for most of the years since 1938.[1] For each year studied, the same general methods of collecting and analyzing the data were employed for the purpose of making the results from year to year directly comparable. Records, collected by the survey method, were obtained from about 500 family-type farm operators in most years. There were approximately 10,000 family-type sugar cane farmers in Louisiana during the earlier part of the 1938-49 period; the number declined to around 6,000 in 1949. The sample studied in most years represents from five to eight per cent of the total number of farmers in the area. In the most recent years of the study, 505 records were collected and analyzed for the 1948 season and 500 for 1949.[2]

The purposes of this report are: (1) to present the costs, income, and net returns of family-type sugar cane producers in Louisiana for the two most recent years studied, 1948 and 1949; (2) to reveal trends in earnings, costs, and farm organization that have become apparent during the entire 12-year period, 1938-49, of the study; (3) to point out the major reasons for the variation in relative returns from year to year; (4) to summarize an analysis of the major factors affecting the success or failure of sugar cane growers on family-type farms in the region; and (5) to outline the labor and machinery requirements and costs in the production of sugar cane on family-type farms in Louisiana. The year by year examination of this 12-year reservoir of economic data has resulted in the discovery of facts of great importance to the Louisiana sugar cane industry. A continuous study of these long-time results in relation to those from the most recent years studied permits further verification of facts already discovered, the determination of new facts, and the observation of trends in costs, earnings, farm organization, and farm practices that are of significance to the industry.

---

[1] *A Farm Management and Cost Study of 500 Family-Sized Farms in the Louisiana Sugar Cane Area, 1938* (Louisiana Experiment Station Bulletin No. 314, February, 1940); *Costs and Returns from 453 Family-Sized Sugar Cane Farms in 1940* (Department of Agricultural Economics Mimeographed Circular No. 25, March, 1942); *Economic Aspects of Sugar Cane Production in Louisiana, 1941* (Department of Agricultural Economics Mimeographed Circular No. 26, June, 1942); *Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1938 to 1945* (Louisiana Experiment Station Bulletin No. 420, June, 1947); *A Study of Major and Minor Factors Affecting Management and Returns on Family Farms in the Sugar Cane Area of Louisiana* (Department of Agricultural Economics Mimeographed Circular No. 86, September, 1948); *Costs and Returns on Family-Type Sugar Cane Farms in Louisiana, 1946 and 1947* (Louisiana Agricultural Experiment Station Bulletin No. 438, March, 1949).

[2] The field schedules for the 1948 study were collected by Henry J. Casso, David Daniel, and Morris M. Lindsey; the records for 1949 were collected by Dallas Lea, Roane Hathorn, and Morris M. Lindsey. The field schedules were checked and tabulated in both years by Erma Lee Facundus.

This phase of the Louisiana sugar cane cost study series has been restricted to family-type farms. A family-type farm is a very elastic item because of differences in intensity. It can be defined best as a farm small enough so that at least one-half of all the man labor operations required in the growing or production of the crop and livestock enterprises on the farm are done by the farm operator and members of his family, and yet large enough so that at least one-half of the gross income of the farm family is derived from the farm.

PROCEDURE

The farms selected as the sample for the first year's study, the 1938 crop year, were chosen on the basis of a stratified-random sampling technique in which a five per cent sample, weighted in accordance with the importance of the sugar cane enterprise in each parish, was selected from the lists of sugar cane growers and acreages per farm supplied by the Agricultural Adjustment Administration. In succeeding years, all of the producers contacted the previous year were visited and where by reason of transfer of farm ownership, retirement, or for other reasons the original cooperators were not available, the next farm adjoining the one missed was contacted. In this way, the continuity of the original sample was maintained and the total volume maintained by the selection of new cooperators to replace those not available. About one-half of the farms surveyed in 1949, the most recent year of this series of studies, were the same farms surveyed in 1938.

Each producer selected was visited by a trained enumerator each year. The enumerator collected from the farmer the detailed results of his previous year's farming operations, including expenses, receipts, practices, and capital changes.

There are two common methods of computing costs and net returns on farms having a specialized enterprise as the main source of income. The first method is to charge all farm expenses, both direct and indirect, to the major enterprise and to credit it with the small miscellaneous sources of income, to result in a "net cost" for the important enterprise. This method is much simpler, easier and more rapid to use in computing sugar cane costs and returns but it has the disadvantage of assuming that the returns from all of the minor small enterprises are enough to balance off exactly the costs of these enterprises, which may or may not be true. If the minor enterprises have not paid expenses, this will result in a higher cost of production for the major enterprise; if the minor enterprises have shown a profit, the net result will be a lower cost for the major enterprise.

The second method is to charge as expenses of the most important enterprise all the direct expenses and then allocate the various indirect expenses according to the proportion of use on the major enterprise. This method is much more difficult to compute and is subject to question because of the detailed accounting and allocating procedure involved but is probably more accurate on farms where there are several important enterprises.

Both methods have been used in this analysis of sugar cane costs and returns on family-type farms in Louisiana; after several years' trial, however, it was found that the income from sugar cane on the farms studied in this area amounted to 80 to 90 per cent of the total income; thus, the "net cost" method was adopted for the long-time series because of its simplicity and relative accuracy under such conditions.

COSTS AND RETURNS, 1938-49

Farm organization and practices change with technological advancements, biological discoveries, and changing economic conditions. Changes in farm organization and practices cause farm costs and farm earnings to vary from year to year. As a result, most production and cost trends can be associated directly with economic, technological, or biological developments. Changes are not the result of the whims of individual farmers. For this reason, in examining the trends in sugar cane costs and returns on family-type farms the underlying physical and economic causes should be observed.

A brief summary of the organization and average financial results from the operation of family-type sugar cane farms in Louisiana for the four most recent years of the study, 1946 to 1949, and averages for the two preceding 3-year periods are shown in Tables 1 and 2. A more detailed analysis of the costs and returns for each year on a per farm, per acre of cane grown, and per ton of sugar cane sold basis is presented in Appendix Tables I to IV.

Volume of Business

From 1938 to the end of World War II, the average volume of business of family-type sugar cane farms in Louisiana, as measured by the acreage in all crops and in sugar cane, gradually declined. For the 1942-45 period, the farms studied had an average of 82 acres of total crops per farm and 39 acres in sugar cane (Table 1). By 1946, total crops per farm had declined to 54 acres and sugar cane to only 25 acres per farm. This trend of a smaller volume of business apparently was due to the shortage of available hired labor during and immediately following the war. This caused the producers to reduce acreages to fit the visible supply of family labor and available local labor.

The total acreage in cropland and in sugar cane for the entire

Louisiana sugar belt did not decline in a similar fashion. On the larger farms, the reduced labor was replaced with mechanized equipment, especially mechanical sugar cane harvesters. As a result, the large corporate-type sugar cane farms actually increased average acreages during this period. Because of the large capital requirements for machinery and the need for a high volume of business to make such equipment efficient, the small family-size farmers were unable to take advantage of the new developments in mechanization as rapidly as the larger farms. After 1946, however, the facts indicate that the volume of business on the family-type farms has been gradually increased. By 1949, the 500 farms studied planted a total of 56 acres of all crops per farm, including 32 acres of sugar cane. The practice of custom-harvesting of sugar cane on the farms too small to justify an investment in a cane harvester has slowly increased since 1946. This service has enabled these family-type producers to increase cane acreage since the low point at the end of the war.

TABLE 1. Number and Size of Family-Type Sugar Cane Farms Surveyed in the Louisiana Sugar Cane Area, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949

Item	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
Number of farms	473	243	503	500	505	500
Acres of cane per farm	37	39	25	26	27	32
Total acres in crops per farm	81	82	54	54	54	56
Yield of cane per acre	18	23	18	18	22	19
Tons of cane sold per farm	633	823	431	435	580	572

Average yields per acre for sugar cane on the farms studied varied from a high point of 23 tons per acre in 1943 and 1945 to only 14 tons per acre in 1940. For the ten years studied, the averge yield was less than 20 tons in five years, from 20 to 22 tons in three years, and averaged 23 tons in two years. Yields of sugar cane for the farms studied were slightly higher in some years than average yields for the state as a whole but followed the same general trends. With the more expensive but more careful hand cultivation practices followed by most family-type growers, somewhat higher yields should be expected.

Over the period studied, family-type sugar cane producers in Louisiana have gradually become more specialized sugar cane producers. The relative importance of other crops has declined. In 1938, 47 per cent of the total cropland was planted to sugar cane; in 1949, about 58 per cent of the cropland was in sugar cane. In addition to sugar cane the most important crop was corn which was planted as the rotation crop, usually interplanted with soybeans, to prepare the land for plant cane. The major cash crops other than sugar cane included cotton, onions, shallots, potatoes, and various truck crops. In most of the years during the period studied, these crops were more speculative and less profitable than sugar cane and many of the family-type sugar cane growers have reduced their production of these crops.

Costs and Returns Per Farm

The average costs and returns per farm for the 5-year period 1938-42, the 3-year period 1943-45, and annually from 1946 through 1949 are shown in Table 2. For purposes of simplicity, all farm expenses have been grouped under two headings, *direct farm expenses,* and *rent and interest.* The first of these groups includes all the usual farm expenses such as feed, seed, hired labor, repairs, fertilizer, and similar items. The second group, rent and interest, includes the actual rent paid by the operators of tenant farms and a computed interest charge of 5 per cent on the average capital investment for owner-operated farms. Interest actually paid by the farmers for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This approach placed all farms on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. A detailed breakdown of all the individual items of cost and return is shown in Appendix Table I.

TABLE 2. Costs and Returns from Producing Sugar Cane on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949

Costs and Returns per Farm	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			Dollars			
Direct farm expenses	2,542	3,983	2,589	2,746	3,002	3,283
Rent and interest	675	1,158	825	904	972	1,039
Total	3,217	5,141	3,414	3,650	3,974	4,322
Receipts from sources other than sugar cane	516	806	540	663	789	531
Net cost of producing sugar cane	2,700	4,335	2,874	2,987	3,185	3,791
Total returns from cane sold	2,644	5,257	3,273	3,709	3,860	4,198
Profit from sugar cane to pay operator for his labor	22	922	399	722	675	407
Value of farm privileges	391	663	537	693	655	704
Total cash and non-cash profits from sugar cane	336	1,585	936	1,415	1,330	1,111
Cash returns per month	5	77	33	60	56	34
Non-cash returns per month	33	55	45	58	55	59
Total returns per month to pay operator for his labor	28	132	78	118	111	93

Total expenses on family-type sugar cane farms have gradually increased since the end of World War II. In 1946, total costs per farm were $3,414 as compared to $4,322 in 1949. This was due to two major factors: the prices paid for the major items used in production on these farms, such as feed, seed, gasoline, and man labor, gradually increased from 1946 to 1949; in addition, there was a slight increase in the average volume of business which resulted in somewhat greater total costs. The net costs of producing sugar cane, or the difference between total costs and income from sources other than sugar cane, varied in about the same proportion as total cost—about $900 per farm higher in 1949 than in 1946.

The net cash profit from sugar cane production to pay the operator for his labor varied from an average of $922 per farm for the 1943-45 period to $399 in 1946, $722 in 1947, $675 in 1948, and $407 in 1949. For the 10 years studied between 1939 and 1949, these farmers lost money, on the average, in two years, made from $200 to $500 in five years, and made peak earnings of from $800 to $900 per farm in three years. On a monthly basis, these farmers made peak cash earnings of about $75 per month, or $3 per working day, in 1943, 1944, and 1945, lost $7 per month worked in 1938 and $50 per month in 1940, and made $34 per month in 1949.

These cost and return data indicate clearly why about 4,000 family-type sugar cane producers, or approximately 40 per cent of the farmers producing sugar cane in Louisiana, did not grow sugar cane between 1938 and 1949. Although they did make cash earnings of $3 per day in the period between 1943 and 1945, the memory of 1940, when instead of making a profit, they lost about $2 per day, and the knowledge that in most of the years since 1945 they could earn twice as much or more than their current level of earnings by working for nearby industries, or even nearby sugar cane producers, caused many to abandon sugar cane farming.

There are additional advantages, however, which family-type farmers have that are not enjoyed by industrial workers and are not reflected in cash net earnings. These are the so-called farm privileges or non-cash items of value which a farmer receives by virtue of the fact that he lives on a farm. If it were not for these non-cash items of value, an even larger proportion of the family-type sugar cane producers in Louisiana would have left the farm in the 1938-49 period.

For each year studied, all producers surveyed were asked to place their own values for these non-cash items. The total of these farm privileges averaged $391 per farm for the 1938-42 period, increased to $663 per farm in the 1943-45 period, and amounted to $704 per farm in 1949. This amounted to a non-cash return in addition to cash earnings of $33 per month in the prewar years, $55 per month during the war, and $59 per month in 1949. Farmers' valuations of milk, meat, vegetables, and fruits produced on the farm and consumed by the farm family tend to follow trends in the costs of these products in retail markets, and thus were higher in 1949 than in earlier years.

By adding these non-cash returns to the cash returns, a total earnings figure can be obtained that is comparable to the earnings of industrial workers. For the sugar cane farmers surveyed, total labor earnings for the year's work, including these non-cash items, averaged $28 per month for the prewar period, increased to $132 per month during the war, and varied from $78 in 1946 to $118 in 1947, $111 in 1948, and $93 in 1949.

These family-type sugar cane farmers had average capital investments totaling about $8,000 per farm in the prewar years. During the war, increased land values plus high costs for tractors and similar equipment items caused an increase to $11,540 per farm, but declining land values and increased availabilities of machinery reduced this level to an average of $9,180 in 1949. They valued their own labor at the rate they could have earned if they had worked for nearby farmers and varied it from an average of $545 per man per year in the prewar period to a high point of $1,269 in 1948 and $884 in 1949. If they had charged the value of their own labor to the farm at these rates during the years studied, they would have made a return on their capital investment varying from a loss of about 10 per cent in 1940 to a gain of about 5.4 per cent in the peak year, 1943. In respect to this return on the capital investment, losses occurred in four of the ten years studied between 1938 and 1949; there was a net return to capital varying from 1 to 4 per cent in four years, and a return of more than 5 per cent in two years.

Costs and Returns Per Acre of Sugar Cane

A summary of the average costs and returns per acre of sugar cane throughout the period studied is presented in Appendix Table II. These data are summarized as averages for the 5-year period 1938-42, the 3-year period 1943-45, and annual data for 1946 through 1949. The net cost of producing sugar cane varied from $73 per acre in the prewar period to $111 during the peak years of the war and to an all-time high of $120 per acre in 1949. Net costs per acre of sugar cane grown on family-type farms increased 65 per cent from the prewar period to 1949.

The net cash income over all expenses except the value of the farmer's own labor amounted to a loss of $2 per acre in 1938, a loss of $17 per acre in 1940, and a profit of from $12 to $27 per acre from 1942 to 1949. The average net profit per acre in the 1943-45 wartime period was $24 per acre; net returns in 1947 and 1948 were slightly higher than this average but returns in 1949 declined to $13 per acre, a new low for the postwar period.

Costs and Returns Per Ton

A summary of the average costs and returns per ton of sugar cane sold for the 12-year period studied is presented in Appendix Table III. These data are summarized as averages for the 5-year period 1938-42, and the 3-year period 1943-45, and annual data for 1946 through 1949. The net cost to the farmer of producing a ton of sugar cane varied from an average of $4.36 per ton during the prewar period to $5.27 during the wartime years and averaged $6.62 per ton in 1949. Costs per ton vary to a greater extent than costs per acre because of the influence of widely varying yields per acre from year to year. If the value of the operator's labor which has not been included as a charge to the sugar cane enterprise were added to the other costs, the result would be an average cost of producing a ton of sugar cane of $5.29 in the prewar period, $6.37 during the war, and $8.17 in 1949. These figures are comparable to the net costs of any business concern using standard accounting methods.

From the point of view of the family-type farmer, who assumes that his labor is worth what he earns on the farm, the cash profit remaining to pay him for his labor amounted to a loss of $0.16 per ton in the prewar period, a gain of $1.12 per ton during the three peak war years, and profit varying from $0.93 per ton in 1946 to $1.66 in 1947, $1.26 in 1948, and $0.72 in 1949.

Returns Per Hour of Labor

The average labor returns to the operators of family-type sugar cane farms in Louisiana for the 5-year prewar period, the 3-year peak war period, and annual data from 1946 through 1949 are shown in Appendix Table IV. The farmers surveyed had a cash loss of two cents per hour worked in the prewar period, made a cash profit of 36 cents per hour during the war, and cash profits varying from 16 cents per hour in 1946 to 28 cents in 1947, 26 cents in 1948, and 16 cents per hour in 1949. In addition, the value of their non-cash farm privileges varied from 15 cents per hour worked in the prewar period to 26 cents during the war and 28 cents per hour in 1949. Thus their total returns, including both cash and non-cash earnings, amounted to 13 cents per hour in the prewar years, 62 cents per hour during the war, and varied from 37 cents in 1946 to 55 cents in 1947, 52 cents in 1948, and 44 cents in 1949.

The farmer's estimate of the value per hour of his own labor was about equal to the cash return per hour for the entire 1938-49 period as a whole, although variations occurred from year to year. The average minimum wage rate set by the Department of Agriculture under the provisions of the Sugar Act also were reasonably close to the average earnings of the family-type farmers surveyed. In three of the ten years studied, the hourly earnings of these family-type farmers were much lower than the established minimum wage rates; in two years the earnings were at about the same level, and in five years the hourly earnings of the farm operators were about 10 cents per hour higher than the minimum wage rates for hired labor.

For the entire 1938-49 period, family-type sugar cane farmers valued their own labor at about the same rate as the actual earnings from the sugar cane enterprise. Thus, they received about the same returns working on their own farms as they would have by working for nearby farmers.

Average Costs and Returns for the 12-year Period, 1938-49

A summary of the average costs, returns, and net profits for all of the farms studied for the entire 12-year period, 1938 to 1949, is shown in Table 3. These data are computed on the basis of a simple average of the results for each year studied. A simple average was used because the number of farms studied varied from more than 500 in some years to 110 in another. A weighted average would overemphasize the results of the years in which a relatively large number of records was obtained.

TABLE 3. Costs and Returns for Family Farms in the Louisiana Sugar Cane Area for the 12-Year Period, 1938-49

Costs and Returns	Annual Average for 12-Year Period			
	Per Farm	Per Acre of all Crops	Per Acre of Cane	Per Ton of Cane Sold
	——Dollars——			
Farm Receipts				
Cane sold for sugar*	3,874	54.55	113.93	6.11
Other crops sold	424	5.97	12.48	.67
Livestock & livestock products	75	1.05	2.20	.12
Other income	150	2.11	4.41	.23
Total receipts	4,523	63.68	133.02	7.13
Farm Expenses				
Hired labor	1,441	20.29	42.37	2.27
Unpaid family labor**	267	3.76	7.85	.42
Fertilizer	220	3.10	6.47	.35
Feed, seeds, and plants	126	1.77	3.72	.20
Machinery and building costs	534	7.52	15.70	.84
Land rent***	470	6.61	13.82	.74
Interest***	454	6.39	13.35	.72
All other farm expenses	531	7.48	15.62	.84
Total expenses	4,043	56.92	118.90	6.38
Income				
Labor income	480	6.76	14.12	.75
Value of farm privileges	575	8.09	16.91	.91
Labor earnings	1,055	14.85	31.03	1.66
Value of operator's time	796	11.21	23.41	1.26
Return to capital	138	1.94	4.06	.22
Per cent return to capital	2	—	—	—
Capital investment, dollars	8,966	126	263	14
Acres in all crops	71	1	—	—
Acres in cane	34	—	1	—
Tons of cane sold	634	9	19	—

*Total receipts from cane sold, including government payments.

**Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

***Includes land rent at actual cost and interest on owned investment at 5 per cent of the value of the depreciated assets.

For the entire period, the farms studied had an average annual volume of business of 71 acres in all crops, 34 acres in sugar cane, 634 tons of cane sold per farm per year, and a capital investment of $8,966 per farm. They obtained a 12-year average sugar cane yield of 19 tons per acre and had an average capital investment of $14 per ton of cane sold.

During the 1938-49 period, these family-type sugar cane farmers produced sugar cane at an average cost of $119 per acre, or $6.38 per ton of cane sold; this did not include the value of the unpaid labor of the farm operator as a cost. Of the total expenses, 42 per cent was for direct labor costs, 23 per cent for rent and interest, 13 per cent for machinery and building repairs, and 22 per cent for all other costs.

The average annual gross income for the 12-year period amounted to $133 per acre, or $7.13 per ton of cane sold. Of this amount, $6.11 per ton, or 86 per cent, was income from sugar cane. About 9 per cent of the total income was from other crops sold, including cotton, potatoes, and truck crops, 2 per cent was from sales of livestock and livestock products, and the remaining 3 per cent included income from various sources such as soil conservation payments and work off the farm.

The labor income, or the amount of cash remaining to pay the farm operator for his year's work on the farm, averaged $480 per farm per year, $14 per acre of sugar cane produced, or $0.75 per ton of cane sold. In addition, these farmers received an average of $575 per year, or $0.91 per ton of cane sold, in the form of the non-cash value of the farm perquisites or privileges produced by the farm and used by the farm family. The total labor earnings for the period, including both cash and non-cash income, averaged $1,055 per farm per year, or $1.66 per ton of sugar cane sold.

If the records are adjusted according to the usual accounting methods used by business firms in which all labor is included as a cost and the value of the farmer's own labor is added to obtain a net income representing the return to the capital investment, the result is an average return to capital of $138 per year on a capital investment of about $9,000. This is an average annual capital return of less than 2 per cent.

These facts indicate that the family-type sugar cane farmers in Louisiana who remained in production throughout the war and early postwar years did not operate at a loss. They had an average monthly level of earnings for the 12-year period of about $90 per month, including both cash and non-cash items of income. This level probably is considerably less than that earned by their neighbors who left their farms and went to work for wartime industries. On the other hand, these producers did have, and still have, a fairly stable job. They have maintained their capital investments and earned some return on this capital, and they have had, and still have, more freedom of action and greater security than their neighbors who left the farm.

ORGANIZATION AND OPERATION OF FAMILY-TYPE SUGAR CANE FARMS

For the most efficient interpretation and use of the cost and return data, a background should be obtained of the essential physical and economics factors relative to the organization and operation of the farms studied. This series of annual studies of family-type sugar cane producers in Louisiana from 1938 through 1949 has made possible the collection of much additional information on sugar cane farming in the region other than the usual cost and return data. Some of the more important of this related information follows.

Tenure

In the 1938-42 prewar period, about 29 per cent of the farmers surveyed owned all the land they operated; 31 per cent operated as part owners and renters, farming the place on which they lived and renting additional land; 18 per cent rented their farms for a stipulated cash sum agreed on between the landlord and tenant at the beginning of the growing season; and the remaining 22 per cent rented their farms on a share basis. The most usual share-rent arrangement was for the farm operator to pay one-fourth of the cane, corn, and cotton crop for the use of the entire farm, including a house in which to live and the usual farm buildings for care of livestock and storage of farm products and machinery, for the year. Under this arrangement, the tenant supplied all the workstock, equipment, seed, and fertilizer used in making the crop and made all managerial decisions.

During the 12-year period covered by these studies, there were no important changes in the relative tenure of the farmers studied (Appendix Table V). In 1949, the most recent year covered, 32 per cent of the 500 farmers surveyed, were full owners, 23 per cent were part owners and renters, 15 per cent were cash renters, and 30 per cent were share renters. There was a slight decline during the period in the number of part owners and a slight increase in the relative number of share renters. This is accounted for by the fact that the total number of farms in the area declined substantially during the 12-year period and those producers leaving their farms for other occupations usually maintained ownership of the land and rented it on shares to nearby farmers.

A special study of farm costs and returns in different tenure groups made in 1946 and checked with later data indicates that there was little difference in relative costs and net returns in the various tenure groups. The rented farms in most years were the larger farms and any advantage in lower capital costs in ownership was offset by the lower costs obtained by the larger volume of business possible when additional land was rented.

Capital Investment

Total capital investment of owner-operated family-type farms in the Louisiana sugar cane area averaged $12,000 per farm in 1942 but increased to more than $13,000 per farm in 1949 (Appendix Table VI). The increase in capital investment needed to operate a somewhat smaller average sized farm in 1949 as compared with 1942 was due to increased land values, advancing building costs, and a somewhat larger total investment in machinery and equipment. On the rented farms, in which the land and buildings were financed by the land owners, the average capital investment increased from about $1,000 per farm in 1942 to almost $3,000 in 1949. The increase in this case was due almost entirely to larger investments in tractors and other equipment. In both the owner and the renter groups, there was a significant decline in the investment in workstock. For the most part, these producers were gradually replacing workstock with mechanical power. The net result of this mechanization trend has been to increase the capital requirements for sugar cane farming on both owner and tenant farms.

On the owner-operated farms in 1949, 42 per cent of the total investment was in land, 33 per cent in buildings, 7 per cent in livestock, and 18 per cent in machinery and equipment. For the tenant farms, 74 per cent of their total investment was in machinery and equipment and 26 per cent in livestock. In both groups, there was a gradual trend in the 1940 to 1949 period to increase the relative investment in machinery and equipment and to decrease the investment in workstock.

Workstock Use and Costs

The average mule on the family-type sugar cane farm during the 1938-49 period worked about 1,000 hours per year, cost $150 at the age of three or four years broken for field work, and had an average useful life on the farm of eight years after the purchase date. The average family-type sugar cane farm was a typical four-mule farm during the prewar period but, with the increase in tractor use, changed to a two-mule, one-tractor farm in 1949.

In 1938 mule work cost family-type sugar cane producers an average of 14 cents per hour, but increased to 16 cents in 1942, 26 cents in 1945, and 29 cents in 1949 (Appendix Table VII). The most important factors causing this increase of more than 100 per cent in workstock costs per hour were the increased expenses for grain and hay for feed and the higher costs for man labor needed for care and maintenance of workstock. In 1949, total feed costs accounted for 68 per cent of all expenses, labor costs were 15 per cent, and other costs, including depreciation, veterinary and medicine, shoeing, and the like, were 17 per cent of all expenses.

Tractor, Truck, and Auto Use and Costs

Of the 500 family-type sugar cane farms studied in 1938, 85 had tractors for use on the farm. In 1949, 12 years later, 392 of the 500 farms surveyed owned tractors for use in their sugar cane farming operations. The shift from mule to tractor power on family-type sugar cane farms in Louisiana in the 1938-49 period was the most important change in the farm organization of producers in the region during this time. In 1938, only 17 per cent of the farms had tractors. This ratio increased to 35 per cent in 1945 and to almost 80 per cent in 1949. The addition of tractors to family-type sugar cane farms was greatly accelerated after the end of World War II when tractors and tractor equipment became available.

In the 10-year period 1938-47, family-type sugar cane producers used their tractors an average of 118 nine-hour days per year and had average costs not including the labor expenses of the tractor operator of $0.64 per hour of use. Cash operating costs for fuel, oil and grease, and repairs accounted for 54 per cent of the total expenses, while overhead costs were 46 per cent of the total (Appendix Table VIII).

With the increased number of tractors on sugar cane farms, the average annual use per tractor gradually declined. In 1949, tractors were used on the average only 86 nine-hour days during the year. Because of the decline in usage and increased cost for fuel and materials as well as higher overhead costs due to advancing prices for tractors, the cost per nine-hour day of use increased to $0.94 in 1949.

In 1938, 15 per cent of these sugar cane producers owned trucks for farm use, and the relative number increased to 26 per cent by 1949. Most of these trucks were small one-half-ton to one-ton trucks, generally purchased on used-car lots and used on the farms for general farm work such as transporting feed, supplies, and labor, and in some cases cane from the field to the derrick. The trucks studied throughout the period were used to the extent of 5,000 to 6,000 miles annually. In 1949, the depreciated average value per truck studied was $777; this was an increase of about $200 per truck over prewar average values (Appendix Table IX).

Truck costs averaged about seven cents per mile during the 1938-47 10-year period but increased to nine cents per mile in 1948 and 1949. Both operating costs, mostly expenses for gasoline, tires, and repairs, and overhead costs gradually increased from 1945 to 1949. In 1949, operating costs accounted for 61 per cent of total expenses, while overhead costs were 39 per cent of all costs.

Slightly more than one-half of the family-type sugar cane farmers studied during the 12-year period owned automobiles, which they operated for both farm and personal use. These cars, as in the case of trucks, usually were purchased at used-car lots and were used relatively little in comparison with the normal mileage of new cars. The cars studied were driven 6,000 to 7,000 miles annually, were valued at $395 per car in the 1938-47 period and $576 per car in 1949, and were used for farm purposes to the extent of 50 to 60 per cent of the total mileage (Appendix Table X).

Total costs per mile varied from about three cents in 1938 to almost five cents for the average of the 1937-47 ten-year period and from five to six cents per mile in 1948 and 1949.

Man Labor

Along with the financial and physical data collected from family-type sugar cane farmers for the 1938-45 period, information relative to the actual days and hours of man labor used on the farm also was obtained. In the earlier years of the period, less than one-fourth of the farmers studied had tractors, and even on the farms with tractors much of the power work was still done with mules. In this period, the typical family-type sugar cane farm consisted of a man-and-four-mule unit. By 1949, more than three-fourths of the producers had tractors but they still maintained an average of two mules per farm. In 1949, the typical family-type sugar cane farm was a combined two-mule, one-tractor power unit.

On any farm, the amount of man labor required to produce a crop varies widely from year to year, depending on the condition of the fields, the quality of the hired labor, weather conditions, degree of grass and weed infestation, the yield per acre, and many similar factors as well as the degree of mechanization. Because of these reasons, any labor requirement data cannot be considered completely accurate indicators of the exact labor needed on a specific individual farm. If such informaton is assembled from the experience of a large group of farmers over a period of years, however, it can be considered a fairly reliable guide to measure relative labor requirements from area to area or for different groups of farms in the same region.

Earlier studies in the prewar mule-farming period have indicated that the average labor requirements for planting, growing, and harvesting one acre of sugar cane amounted to 184 hours of man labor. A special study of labor costs and requirements in 1949 indicated that the total man hours required per acre of cane produced averaged 155. Of this amount, 47 hours per acre were used in planting and growing the crop, 66 hours in all harvesting operations on sugar cane, and 42 hours in other farm work including producing the corn crop in rotation, cleaning out ditches, and similar items (Appendix Table XI).

These data indicate that the shift from primarily mule power to the combined mule-power operation on family-type sugar cane farms has been accompanied by a reduction in the amount of man labor required. There is no doubt that such a reduction has occurred, but there is some question as to the extent of this man labor saving. In the earlier prewar period, there were no sugar cane harvesters. In 1949, about 5 per cent of the family-type operators studied hired their crop cut on a custom-harvest basis, thus transferring the man labor cost to a hired-machine cost. They replaced labor dollars with machine dollars. In addition, almost one-half of these family-type farmers hired some machinery work in peak cultivating periods and/or in hauling the crop from the field to the derrick. As a result, a large part of the indicated reduction in man hour requirements has actually been a substitution of hired machinery, including the man on the machine, for the farmer and his regular hired help behind the mule.

In 1949, the average farmer worked 212 nine-hour days on his farm during the year. He estimated this to be worth $4.15 per day. Other family labor on the farm amounted to 59 days and was valued at $3.57 per day. In addition to these workers, an average of 271 nine-hour days of hired farm labor was used per farm. This hired labor cost $3.17 per day for sugar cane growing jobs, $4.47 per day for sugar cane harvesting jobs, and $3.37 per day for other work on the farm. The average family-type sugar cane farm, with 32 acres in sugar cane, 24 acres in all other crops, 2 mules, and 1 tractor, utilized a total of 542 nine-hour days of man labor. Of this labor, 39 per cent was that of the farm operator, 11 per cent was other family labor, and 50 per cent was hired labor. Most of the hired labor was used in November and December to harvest the sugar cane crop.

FACTORS AFFECTING NET RETURNS ON FAMILY-TYPE FARMS IN THE LOUISIANA SUGAR CANE AREA

The unit costs and returns and the profits or losses per farm from the operation of family-type sugar cane farms in Louisiana are affected by a great number of different factors, some under the control of the management and many beyond the control of the individual operators. In this area, the major factors determining the relative costs and returns per farm from year to year are indicated to be the annual variations in the size of the crop, which are the result of weather conditions during the growing season; the kind of prevailing weather during the harvesting season and the presence or absence of damaging frosts; the sucrose content per ton of cane harvested, which is determined in the short run by the weather; and the price received for sugar cane, which is based on the usual cane-purchase contract according to the price of raw sugar. The favorable or unfavorable effect of the first three of these four important factors is dependent, in any one year, on the weather, which is unpredictable. The favorable or unfavorable effect of the last factor, the price of sugar cane, is dependent on raw sugar prices which are established at national and international levels.

In any given year under the same climatic conditions and the same price structure, however, there are still variations from farm to farm in costs, returns, and net profts; thus, there are still other reasons for variations in returns in addition to the major ones listed previously. These factors causing one producer to have lower costs and higher returns than another in the same area and in the same year are both physical and economic in character. The physical factors include selection of varieties; disease and insect control; methods of planting, cultivating, fertilizing, and harvesting; and many others. The economic factors include the wide range of managerial operations and decisions during the operation of a farm.

Numerous studies and observations have shown that the first rule of success in sugar cane production, or in any other type of farming, is to know the common farm practices and methods of the region. This is the reason why one frequently observes successful farmers who have no education, business experience, or other special training other than their years of experience on the farm. Also, many examples can be pointed out of well-trained educated business men or farmers from other areas who started off in sugar cane farming and made a dismal failure because of this lack of experience or knowledge of the common farm practices of the area. Thus, the first step towards success in sugar cane farming on a family-type unit is to know, and be able to do well, all the practical jobs connected with the growing and harvesting of sugar cane. It is the conclusion of most farm management specialists that if a prospective farmer does not have that experience in the area in which he intends to farm, then he will be better off in the long run to go to work for a successful producer in the area who knows his job and to learn from him for a few years while doing the job rather than to start out on his own immediately and take the chance of losing everything.

A second important rule of success in farming is to know the scientific principles of crop and livestock production and especially the detailed peculiarities of the production of a specialized crop such as sugar cane. Many successful sugar cane farmers have gained this "know how" the hard way, through trial and error, observation of others, a thorough study of all available literature on the subject, and day-by-day study of their special problems. Regardless of the source of the facts on scientific principles of crop and livestock production, sugar cane farming is a business and may become a very expensive hobby if the farmer does not know what he is doing, why he is doing it, and why he is not trying out some other way. If in doubt about some special practice, he should look around and see what the great majority of the neighbors are doing, and do likewise. The conservative procedure to follow is to allow the other fellow who has money enough to gamble to do the experimenting or let the agricultural experiment station do it; then when the practice is proved, adopt it.

A third important rule leading towards success in sugar cane farming on family-type units is to know and use the business principles in accordance with which the common farm practices and scientific principles should be applied. These are the so-called farm management principles and were not important in the days when each farm was a self-sufficient unit producing all that was needed for a livelihood and selling very little, but have become more and more important since farming has become specialized and more of a business rather than a way of life. Since this series of studies has been limited to a statistical analysis of the financial results of the operation of family-type sugar cane farms, a study of the effect of the application of these different business principles on costs and returns has been made but no attempt was made to study the physical and internal-management problems of the family-type sugar cane farmers involved in the first two rules of success as listed, although it is recognized that differences do exist and that these variations cause much of the final difference in returns.

The economic factors that were found to be important in affecting costs and returns, as determined from the statistical analysis of the family-type sugar cane farms surveyed from 1938 to 1949, are size of farm, yield per acre, the balance of the farm business, and efficiency in the use of labor and machinery.

Size of Farm

The average size of the family-type sugar cane farm in Louisiana in 1949 was about 90 acres, of which 32 acres were in sugar cane, 24 in other crops—mostly corn—10 in pasture, and the remainder in woods and drainage ditches. The typical farm of this size was operated with one team of mules and one tractor and had about $2,500 invested in horse-drawn and tractor equipment. From 1938 to 1949, there were some changes in the average size. In 1938, these producers averaged 41 acres of sugar cane per farm. This acreage declined to a low point of 25 in 1945 and then gradually increased to 32 in 1949. The major reasons for the decline were the shortage of labor and the difficulties of family-type farmers in obtaining and financing equipment which would be efficient with their relatively small volume of business, during the war years. After the end of the war, increasing availability of satisfactory equipment and a gradual increase in the practice of custom tractor work and custom machine harvesting enabled the farmers, as a whole, to increase the average size of business.

All of the farms, however, were not of the typical or average size. In 1949, 178 producers, or about 36 per cent of all growers studied, had less than 16 acres in sugar cane. On the other hand, 13 per cent of these sugar cane farmers grew more than 60 acres of sugar cane per farm. The remaining 51 per cent had acreages ranging from 16 to 59 acres per farm.

Within the limits of the size of the family-type farms studied, the larger the size of the farm business as measured in terms of the acreage of all crops or the acreage in sugar cane, the lower were the costs of producing sugar cane and the greater were the profits from the entire farm business.

In 1949, for instance, the 178 producers growing less than 16 acres of sugar cane per farm had an average labor income of only $184 per farm while the 148 growers with more than 40 acres of cane earned $823 per farm (Appendix Table XII). This general relationship of size to net returns has held true in all the years studied from 1938 through

1949, with the exception of 1940. The year 1940 was one of the most disastrous years in the recent history of the Louisiana sugar cane area owing to weather conditions which caused yields to be only about 60 per cent of normal; in such a year, the larger the size of the farm, the greater are the losses.

The analysis of the data for the 12-year series indicates that on the relatively large family-type farms, the producers obtained lower costs and higher returns per unit and per farm because of the larger volume of business and because of the higher efficiency obtained in the use of man labor and machinery. They produced and harvested larger acreages and greater tonnages per man and had lower costs per unit for workstock and tractors because of full utilization of these items.

The 12-year analysis leads to the conclusion that under Louisiana conditions a farm of about 100 acres in crops and 50 to 60 acres in sugar cane is needed to maintain an efficient family-type sugar cane farm.

Yield per Acre

Farm management studies throughout the United States have shown that within the actual practices of farmers, the higher the crop yields, the higher are the net returns from farming. Farms with high yields pay higher returns in depression periods as well as in normal or favorable years. Also, good yields of crops and high production rates for animals are the most important factors in obtaining low costs of production. Farmers with high production rates have lower costs per unit and make higher returns per hour of labor than farmers with lower production efficiency.

This general relationship holds true for sugar cane production on family-type units and is probably the most important factor determining the success or failure of a sugar cane producer. In 1949, for instance, with an average yield of 19.4 tons per acre for the entire 500 farms studied, there were 38 producers, or about 8 per cent, who obtained less than 12 tons per acre (Appendix Table XIII). Fifty-two per cent of the growers surveyed in 1949 obtained less than 20 tons of sugar cane per acre. On the other hand, 42 growers, or about 8 per cent, had average yields ranging from 28 to 35 tons per acre.

In 1949, the 106 producers who averaged less than 15 tons per acre had an average labor income of **minus** $232 per farm. Those with yields ranging from 15 to 23 tons per acre made $328 per farm, while the high-yield group, averaging 27 tons per acre, had an average labor income of $1,125. Similar relationships have occurred in all the years in which this series of studies has been conducted.

Since the yield of cane is one of the most important factors determining costs, all things that tend to increase yields at a reasonable cost should be given special consideration. These Louisiana studies indicate that in a normal season a family-type sugar cane producer must make an average yield of 20 tons or more per acre if he is to make a reasonable profit on the enterprise. A basic conclusion of these results is that the sugar cane grower who plans to remain in business for any length of time must develop all possible ways of increasing yields.

Diversification of Enterprises

There are very few cases in agriculture where one product pays well enough to justify complete dependence on it and to justify idleness part of the year. In the Southern States, especially, the more profitable family-type farms are those which have a diversified farm business with a combination of both crop and livestock enterprises. Unfortunately, however, there is no single combination of enterprises which will fit all individual farms within an area. Thus, the exact combination or arrangement of enterprises is an individual problem in each area and for each farmer.

The Louisiana sugar cane area appears fairly well adapted from the standpoint of climatic and soil conditions to the production of a large number of different farm products. Because of the lack of market outlets for a large volume of certain truck crops and the lack of low-cost pasture lands essential to the production of certain commodities such as beef, however, there appear to be very few enterprises that can be used to supplement sugar cane production. Nevertheless, the possibilities for diversification in this area do exist and in some cases are indicated to be profitable.

These studies from 1938 to 1949 show that on the fairly large family-type sugar cane farms where yields of sugar cane were average or above, the larger the percentage of the total acreage planted to sugar cane and the smaller the dependence on other sources of income, the lower were the costs for producing cane and the greater were the total profits from the entire farm business (Appendix Table XV). The larger of these farms, averaging from 50 to 100 acres in sugar cane per farm, were efficient enough in the production of sugar cane so that the more they specialized in sugar cane alone, the more they made.

For the many smaller family-type farms, however, a different result is indicated. For such farms, averaging 2 to 15 acres in sugar cane and 10 to 30 acres in all crops, the results for each year studied in the 1938-1949 period show that the producers in this size group who specialized in sugar cane production alone made lower total returns from the year's work than did those who had other crop enterprises in addition to sugar cane and corn.

In the northern part of the sugar cane belt the enterprises that appeared to be best suited for combining with the cane crop on these small farms were onions, Irish potatoes, and cotton. In the eastern part of the area, strawberries, shallots, and early snap beans were planted most frequently with success in most years by the small growers. In the central part of the cane belt, shallots and early Irish potatoes supplied additional income for the small growers, while in the western area, sweet potatoes, rice, and canning crops such as okra, snap beans, and pepper appeared to be supplementary enterprises to sugar cane on the small family-type farms.

Efficiency in the Use of Labor

Good labor efficiency increases farm returns in all areas. Labor efficiency refers to the amount of productive work accomplished per man working on the farm; in general, the more work accomplished per man, the greater are the profits. Efficiency in the use of man labor is especially important in periods of high prices or in areas of high labor costs. Large farms with poor labor efficiency are usually among the least profitable units. The advantages obtained by a large size business can be maintained only by efficient use of all available labor.

On the farms studied, there appeared to be a wide variation in the amount of productive work accomplished per man. The least efficient group produced sugar cane at the rate of 4 to 6 acres per man, those of medium efficiency had rates of accomplishment of 8 to 10 acres per man, while the most efficient producers from the standpoint of labor utilization grew and harvested cane at the rate of 16 to 24 acres per man. In all the years studied, the average labor earnings per farm were about twice as high for the group with medium labor efficiency as compared with the lowest group and were from two to three times as high for the group with the most efficient use of labor as compared with those with medium efficiency.

These studies indicate that the producers who obtained the highest labor efficiency were those who had relatively large-sized farms so that there was work to be done throughout the year, those who organized and planned their work in advance, and those who had sufficient machinery and equipment of the proper type and size to do each job in the most efficient manner. In addition, there is still another factor associated with labor efficiency which cannot be measured statistically but which was the cause of some of the variations; that is the desire and the inclination to work.

SUMMARY

1. Detailed farm management and cost studies of the operation of family-type sugar cane farms in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station annually from 1938 through 1949, with the exception of two years, 1939 and 1941. This report summarizes the results of this series of studies for the 12-year period.
2. Records were collected from approximately 500 farmers in most years. The annual sample studied represented from 5 to 8 per cent of the total number of sugar cane farmers in the area.
3. From 1938 to the end of World War II, the average volume of business of family-type sugar cane farmers in Louisiana gradually declined. In 1938, they grew 41 acres of sugar cane per farm; by 1945, this had declined to 25 acres. This trend was apparently due to the shortage

of available hired labor during and immediately following the war. Since 1945, the cane acreage per farm has gradually increased to postwar peak of 32 acres per farm in 1949.

4. Average yields per acre of sugar cane fluctuated from a high point of 23 tons in 1943 and 1945 to only 14 tons in 1940. For the period studied, the average yield was less than 20 tons in five years, from 20 to 22 tons in three years, and averaged 23 tons in two years.

5. The net profit to pay the farmer for his labor varied from an average of $922 per farm for the 1943-45 period to $399 in 1946, $722 in 1947, $675 in 1948, and $407 in 1949. For the entire period studied, these farmers lost money in two years, made from $200 to $500 per farm in five years, and made peak earnings of from $800 to $900 per farm in three years. On a monthly basis, these producers had peak cash earnings of about $75 per month in 1943, 1944, and 1945, lost $7 per month worked in 1938 and $50 per month in 1940, and made $34 per month in 1949.

6. The net cash cost of producing a ton of sugar cane varied from an average of $4.36 per ton during the prewar period to $5.27 during the wartime years and averaged $6.62 per ton in 1949. Adding to these figures the value of the farmer's own labor to obtain a cost equivalent to the cost of a business concern, the result was an average cost per ton varying from $5.29 in the prewar period to $6.37 during the war and $8.17 in 1949.

7. For the entire period, family-type sugar cane farmers produced sugar cane at an average cost of $119 per acre, or $6.38 per ton of cane sold, not including the value of the farm operator's labor as a cost. Gross income for the period averaged $133 per acre of sugar cane, or $7.13 per ton of cane sold. The labor income, or the amount of cash remaining to pay the farmer for his year's work on the farm, averaged $480 per farm, $14 per acre of sugar cane produced, or $.75 per ton of cane sold.

8. The typical family-type unit in the prewar period was a four-mule farm; less than one-fourth of the producers studied had tractors, one-third had trucks, and about two-thirds had a family automobile which was used for farm and personal use. By 1949, however, the typical farm was a one-tractor, two-mule farm. About 80 per cent of the farms surveyed in 1949 owned tractors. The shift from mule to tractor power on family-type sugar cane farms in the 1938-49 period was the most important change in farm organization of the region during that time.

9. Workstock costs varied from 14 cents per hour in the prewar period to 29 cents in 1949; tractors were operated at a total cost of 61 cents per hour in 1938 and 94 cents in 1949; truck expenses varied from less than 6 cents per mile in 1938 to 9 cents in 1949; and automobile costs were about 3 cents per mile in 1938 and 6 cents in 1949.

10. The financial results of this series of studies of family-type sugar cane farms show that in any given year and under the same climatic conditions and the same price structure, there are still variations

from farm to farm in costs, returns, and net profits. The major economic factors influencing net returns were found to be the size of the farm, the yield of cane per acre, the proportion of the cropland planted to cane, and the relative efficiency of the use of man labor.

11. Within the limits of the size of the family-type farms studied, the larger the size of the farm business, the lower were the costs of producing sugar cane and the greater were the profits from the entire farm business. A size of farm of about 100 acres in crops of which 50 acres are in sugar cane is indicated to be needed to maintain the most efficient family-type sugar cane farm.

12. The most important single factor influencing the financial success of the farms studied was the yield per acre of sugar cane. In all years studied, the producers obtaining relatively high yields had lower costs per unit and higher net returns. The facts indicate that in a normal season the farmer who does not average a 20-ton yield on his entire acreage is also the one who does not make a profit on the enterprise.

13. The larger of the family-type farms, averaging from 50 to 150 acres in sugar cane, were efficient enough in the production of cane so that the more they specialized in sugar cane alone, the more they made. The smaller family-type farms, with 2 to 15 acres in cane, made greater total returns for the year when they diversified their farm businesses by the addition of other cash crop enterprises and were not completely dependent on the sugar cane crop for all cash income.

APPENDIX

TABLE I. Average Costs and Returns per Farm on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, Annual 1946, 1947, 1948, and 1949

Item	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			—Dollars—			
Farm Receipts:						
Cane sold for sugar*	2,644	5,257	3,273	3,709	3,860	4,198
Other crops sold	322	508	392	460	626	275
Other income	109	230	84	117	109	169
Livestock & livestock products	86	68	64	86	54	87
Total	3,161	6,063	3,813	4,372	4,649	4,729
Farm Expenses:						
Hired labor	1,252	2,110	1,067	1,027	1,154	1,080
Unpaid labor**	230	313	224	339	275	205
Fertilizer	141	244	193	226	293	336
Feed, seeds, and plants	96	128	148	170	122	146
Machinery & bldg. costs	294	533	687	750	840	581
Land rent***	277	581	452	498	590	580
Interest***	397	577	373	406	382	459
All other expenses	530	656	270	234	318	935
Total	3,217	5,142	3,414	3,650	3,974	4,322
Income:						
Labor income	— 56	921	399	722	675	407
Value of farm privileges	391	663	537	693	655	704
Labor earnings	335	1,584	936	1,415	1,330	1,111
Value of operator's time	545	890	770	737	1,269	884
Return to capital	— 204	608	2	391	— 212	— 18
Capital investment	7,947	11,540	7,460	6,927	7,640	9,180

*Total receipts from cane sold, including government payments.

**Value of unpaid family labor at the going wage rate, not including the labor of the farm operator.

***Includes rent at actual cost and interest on owned investment at 5 per cent of the depreciated assets.

TABLE II. Costs and Returns per Acre of Cane Grown on Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and annual 1946, 1947, 1948 and 1949

Costs and Returns per Acre	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			—Dollars—			
Direct farm expenses	68.61	102.79	102.00	106.00	111.19	104.24
Rent and interest	18.31	30.05	33.00	34.00	36.00	32.98
Total	86.92	132.84	135.00	140.00	147.19	137.22
Receipts from sources other than sugar cane	14.17	21.44	21.00	25.00	29.22	16.85
Net cost of producing sugar cane	72.75	111.40	114.00	115.00	117.97	120.37
Total returns from cane sold	71.27	135.22	129.00	143.00	142.96	133.28
Profit from sugar cane to pay operator for his labor	— 1.48	23.82	15.00	28.00	24.99	12.91
Value of farm privileges	10.73	17.32	21.00	27.00	24.26	22.35
Total cash and non-cash profits from sugar cane	9.25	41.14	36.00	55.00	49.25	35.26
Value of operator labor	14.96	23.16	30.00	28.00	47.00	28.06
Net gain over value of operator labor	— 5.70	17.98	6.00	27.00	2.25	7.20
Acres of cane per farm	37	39	25	26	27	32

TABLE III. Costs and Returns per Ton of Cane Sold for Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45, and Annual 1946, 1947, 1948 and 1949

Costs and Returns per Ton of Cane Sold	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			—Dollars—			
Direct farm expenses	4.14	4.86	6.01	6.31	5.60	5.74
Rent and interest	1.12	1.42	1.91	2.07	1.81	1.81
Total	5.26	6.28	7.92	8.38	7.41	7.55
Receipts from sources other than sugar cane	.89	1.01	1.25	1.53	1.47	.93
Net cost of producing sugar cane	4.36	5.27	6.67	6.85	5.94	6.62
Total returns from cane sold	4.20	6.39	7.60	8.51	7.20	7.34
Profit from sugar cane to pay operator for his labor	— .16	1.12	.93	1.66	1.26	.72
Value of farm privileges	.65	.82	1.24	1.59	1.22	1.23
Total cash and non-cash profits from sugar cane	.49	1.94	2.17	3.25	2.48	1.95
Value of operator labor	.93	1.10	1.79	1.69	2.37	1.55
Capital investment per ton	13.34	14.29	16.08	14.77	14.25	16.05
Tons of cane produced per farm	691	874	464	469	580	603
Tons of cane sold per farm	633	830	431	435	536	572

TABLE IV. Average Labor Returns to the Operator from the Sugar Cane Enterprise for Family-Type Sugar Cane Farms in Louisiana, Average 1938-40-42, 1943-44-45 and Annual 1946, 1947, 1948 and 1949

Costs and Returns	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			—Dollars—			
Costs and Returns per Farm						
Income from sugar cane	2644	5257	3273	3709	3860	4198
Net costs	2700	4335	2874	2987	3185	3791
Cash profits to pay operator for his labor	— 56	922	399	722	675	407
Value of farm privileges	391	663	537	693	655	704
Total profit to pay operator for his labor	335	1585	936	1415	1330	1111
Costs and Returns per Hour						
Cash returns per hour of labor*	— .02	.36	.16	.28	.26	.16
Non-cash returns per hour of labor*	.15	.26	.21	.27	.26	.28
Total returns per hour of labor*	.13	.62	.37	.55	.52	.44
Farmer's estimate of value per hour of his labor	.22	.35	.30	.29	.50	.35
Minimum wage rate in the area**	.16	.25	.40	.40	.40	.41

*Based on an average of 10.1 months of 25 working days of full-time work on the farm as reported by the farmers surveyed, or a total of 2,550 hours of work for the year.

**Estimated hourly rate based on rates established by the U. S. Department of Agriculture for each year.

TABLE V. Tenure of Farm Operators Surveyed, Family-Type Louisiana Sugar Cane Farms, Average 1938-40-42, 1943-44-45 and Annual 1946, 1947, 1948 and 1949

Item	Average		Annual			
	1938-40-42	1943-44-45	1946	1947	1948	1949
			—Number—			
Farms in each tenure group:						
Full owners	136	97	195	189	139	159
Part owners and renters	145	46	80	93	91	115
Cash renters	86	48	80	90	104	73
Share renters	106	52	148	128	171	153
Total	473	243	503	500	505	500
Proportion in each group:						
Full owners	28.8	39.9	38.8	37.8	27.5	31.8
Part owners and renters	30.6	18.9	15.9	18.6	18.0	23.0
Cash renters	18.2	19.8	15.9	18.0	20.6	14.6
Share renters	22.4	21.4	29.4	25.6	33.9	30.6
Total	100.0	100.0	100.0	100.0	100.0	100.0

TABLE VI. Distribution of Capital Investment on Family-Type Sugar Cane Farms in Louisiana

Capital Items	Average Investment per Farm			
	Owners		Renters	
	1942	1948	1942	1948
		—Dollars—		
Land	5,643	5,437	—	—
Buildings	3,428	4,313	—	—
Total real estate	9,071	9,750	—	—
Workstock	747	380	520	383
Cattle	318	360	155	175
Other livestock	214	209	105	168
Total livestock	1,279	949	780	726
Tractors	537	1,133	14	1,025
Trucks	231	118	5	93
Farm automobiles	372	169	169	129
Other equipment	862	977	271	775
Total machinery & equipment	2,002	2,397	459	2,022
Total Investment	12,352	13,096	1,239	2,748

TABLE VII. Costs of Mule Work on Louisiana Family-Type Sugar Cane Farms, Selected Years, 1938-1949*

Cost per Mule	1938	1942	1945	1949
		Dollars		
Grain, 2 tons	50	74	126	136
Hay, 3 tons	30	28	54	60
1 acre of pasture	5	5	6	7
Man labor, 114 hours	17	21	31	43
Depreciation[1]	19	19	19	19
Interest[2]	4	4	4	4
Shoeing	4	4	5	6
Veterinary and medicine	1	1	2	3
Use of buildings	1	1	1	1
Harness costs	5	6	7	8
Total cost for year	136	163	255	287
Cost per hour[3]	14c	16c	26c	29c

*Based on special physcial requirements studies made in 1938 and 1941 and actual prices paid per unit for each year.

[1] Established on an average cost per mule of $150 and an average 8-year useful life.

[2] Interest on average value of $75 per mule at 5 per cent.

[3] Based on an average use of 1,000 hours per year.

TABLE VIII. Cost of Tractor Work on Family-Type Sugar Cane Farms in Louisiana, 1948-49

Costs	Average 1938-1947	1948	1949
		Dollars	
Cost per Day of Use (9 hours):			
Fuel oil and gasoline	1.80	2.66	2.71
Lubricating oil and grease	.34	.39	.54
Repairs	.74	1.15	1.29
Other Cash costs	.27	.20	.39
Total operating expenses	3.15	4.40	4.93
Depreciation	2.03	3.78	2.31
Interest	.60	.96	1.16
Total overhead expenses	2.63	4.74	3.47
Total costs	5.78	9.14	8.40
Operating costs per hour	.35	.49	.55
Overhead costs per hour	.29	.52	.39
Total costs per hour	.64	1.01	.94
Number of tractors studied per year	160	311	392
9-hour days of use per tractor per year	117.9	96.7	86.2
Average value per tractor (dollars)	1326	1854	1994

TABLE IX. Costs of Operating Farm Trucks on Family-Type Sugar Cane Farms in Louisiana, 1948-1949

Costs	Average 1938-1947	1948	1949
		Cents	
Cost per Mile of Use:			
Gasoline	1.88	2.19	2.37
Oil and grease	.25	.25	.30
Repairs	1.36	1.92	1.25
Tires	.83	.87	.82
Insurance	.21	.26	.51
License	.23	.15	.14
Total operating costs	4.76	5.64	5.39
Depreciation	2.05	2.71	2.69
Interest	.55	.68	.75
Total overhead costs	2.60	3.39	3.44
Total costs per mile	7.36	9.03	8.83
Number of trucks studied per year	112	67	128
Miles of use per year	5408	5749	5132
Average value per truck (dollars)	580	787	777

TABLE X. Costs of Operating Farm Automobiles on Family-Type Sugar Cane Farms in Louisiana, 1948-49

Costs	Average 1938-1947	1948	1949
		Cents	
Cost per Mile of Use:			
Gasoline	1.32	1.84	1.81
Oil and grease	.19	.25	.26
Repairs	1.08	1.49	1.06
Tires	.43	.44	.37
Insurance	.06	.10	.21
License	.10	.05	.05
Total operating costs	3.18	4.17	3.76
Depreciation	1.13	1.96	1.03
Interest	.34	.51	.46
Total overhead costs	1.47	2.47	1.49
Total costs per mile	4.65	6.64	5.25
Number of automobiles studied per year	278	246	316
Miles of use per year	5948	5955	6295
Average value per car (dollars)	395	605	576
Per cent of use for farm	61	50	49

TABLE XI. Volume and Cost of Man Labor on 500 Family-Type Sugar Cane Farms, 1949

Item	Operator Labor	Other Family Labor	Hired Labor	Total Labor
Days per Farm:				
Sugar cane production	79.3	19.3	65.1	163.7
Sugar cane harvesting	49.2	16.7	163.7	229.6
All other farm work	83.6	23.0	41.9	148.5
Total	212.1	59.0	270.7	541.8
Cost per 9-hour Day, Dollars:				
Sugar cane production	3.94	3.34	3.17	3.56
Sugar cane harvesting	5.16	4.58	4.47	4.63
All other farm work	3.77	3.03	3.37	3.54
Average	4.15	3.57	3.99	4.01
Cost per Farm, Dollars:				
Sugar cane production	314	63	206	583
Sugar cane harvesting	254	74	732	1,060
All other farm work	316	68	142	526
Total	884	205	1,080	2,169
Hours per Acre in Cane:				
Sugar cane production	22.6	5.5	18.6	46.7
Sugar cane harvesting	14.2	4.8	46.8	65.8
All other farm work	23.8	6.5	11.9	42.2
Total	60.6	16.8	77.3	154.7

TABLE XII. Relation of Size of Farm to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49

Costs and Returns per Farm	1944			1946			1949		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
					Dollars				
Farm Receipts:									
Sugar Cane	1,344	4,720	13,823	628	1,947	7,831	1,283	3,248	8,834
All other income	973	552	1,166	616	423	634	642	335	570
Total	2,317	5,272	14,989	1,244	2,370	8,465	1,925	3,619	9,404
Farm Expenses:									
Hired labor	592	2,110	4,949	144	493	2,786	269	719	2,491
All other costs	1,119	2,117	5,951	845	1,247	4,145	1,219	2,195	5,347
Total	1,711	4,227	10,900	989	1,740	6,931	1,488	2,914	7,838
Farm Income	606	1,045	4,089	255	630	1,534	437	705	1,566
Interest costs	261	605	1,465	199	268	747	253	426	743
Labor Income	345	440	2,624	56	362	787	184	279	823
Acres of cane per farm	10	33	108	6	16	59	10	24	66
Tons of cane per acre	22	23	21	15	17	18	19	20	19
Number of farms	52	29	29	159	183	161	178	174	148

TABLE XIII. Variation in Yield per Acre, 500 Family-Type Sugar Cane Farms, 1949

Range in Tons of Cane per Acre	Number of Farms	Average Yield per Acre	Accumulative Percentage
	Number	Tons	Per Cent
Less than 10	18	7.6	3.6
10.1 to 11.9	20	10.4	7.6
12.0 to 13.9	40	12.6	15.6
14.0 to 15.9	62	14.5	28.0
16.0 to 17.9	60	16.4	40.0
18.0 to 19.9	60	18.4	52.0
20.0 to 21.9	66	20.4	65.2
22.0 to 23.9	63	22.5	77.8
24.0 to 25.9	39	24.5	85.6
26.0 to 27.9	30	26.6	91.6
28.0 to 29.9	21	28.4	95.8
30.0 to 31.9	9	30.4	97.6
32.0 to 33.9	6	32.3	98.8
More than 33.9	6	36.2	100.0
Total or average	500	19.4	—

TABLE XIV. Relation of Yield per Acre of Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49

Cost and Returns per Farm	Yield								
	1944			1946			1949		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
	Dollars								
Farm Receipts									
Sugar cane	4,862	5,730	6,147	1,562	3,874	5,288	2,024	4,686	5,006
All other income	970	701	1,097	623	427	588	432	507	708
Total	5,832	6,431	7,244	2,185	4,301	5,876	2,456	5,193	5,714
Farm Expenses									
Hired labor	2,096	2,204	2,487	496	1,264	1,733	531	1,239	1,249
All other costs	2,822	2,066	2,795	1,402	2,175	2,711	1,834	3,105	2,821
Total	4,918	4,270	5,282	1,898	3,439	4,444	2,365	4,344	4,070
Farm Income	914	2,161	1,962	287	862	1,432	91	849	1,644
Interest costs	721	565	327	257	407	531	323	521	519
Labor Income	193	1,596	1,635	30	455	901	—232	328	1,125
Acres of cane per farm	48	41	35	19	31	31	25	36	26
Tons of cane per acre	16	22	29	11	18	24	12	19	27
Number of farms	41	38	31	199	165	139	106	283	111

TABLE XV. Relation of Proportion of Cropland in Sugar Cane to Costs and Returns for Family-Type Sugar Cane Farms in Louisiana, 1944-49

Cost and Returns per Farm	Per cent of cropland in cane								
	1944			1946			1949		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
					——Dollars——				
Farm Receipts									
Sugar cane	1,582	4,632	10,746	894	2,642	5,411	1,914	4,181	7,173
All other income	1,547	502	596	1,059	534	199	907	374	304
Total	3,129	5,134	11,342	1,953	3,176	5,610	2,821	4,555	7,477
Farm Expenses									
Hired labor	1,035	2,071	3,750	332	876	1,723	465	1,058	1,128
All other costs	1,502	1,993	4,249	1,326	1,701	2,646	1,768	2,641	5,113
Total	2,537	4,064	7,999	1,658	2,577	4,369	2,233	3,699	6,241
Farm Income	592	1,070	3,343	295	599	1,241	588	856	1,236
Interest costs	293	686	1,070	315	355	428	352	448	614
Labor Income	299	384	2,273	—20	244	813	236	408	622
Acres of cane per farm	11	36	81	8	21	41	14	31	55
Tons of cane per acre	21	22	22	16	18	19	20	20	19
Percentage of cropland in cane	24	45	62	22	40	61	33	56	74
Number of farms	40	34	36	132	173	198	164	209	127

LOUISIANA BULLETIN NO. 456 JUNE, 1951

FINANCIAL RESULTS OF THE OPERATION OF LARGE SUGAR CANE FARMS IN LOUISIANA, 1937 TO 1949

By

J. NORMAN EFFERSON AND MILDRED COBB

LIBRARY
FEB 3
NEW MEXICO STATE
UNIVERSITY

SURPLUS
TO REQUIREMENTS AS
Superseded
Worn Out
Obsolete
Unsuitable
Duplicated
NMSU LIBRARY
LAS CRUCES

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, *Director*

Table of Contents

INTRODUCTION 5

PROCEDURE 5

Items of Cost 6

MEASURES OF COST AND RETURN 7

LIMITATIONS OF THE DATA 8

OTHER CONSIDERATIONS 9

COSTS AND RETURNS 10

Volume of Business 10

Net Returns per Farm 11

Costs and Returns per Acre 12

Costs and Returns per Ton 14

Thirteen-Year Average Costs and Returns 15

FACTORS AFFECTING COSTS AND RETURNS 17

Size of Farm 19

Yields per Acre 20

Efficiency in the Use of Man Labor 21

Proportion of Cropland Planted to Cane 22

Geographic Variations 23

SUMMARY 24

APPENDIX 26

LIST OF TABLES

TABLE PAGE

1. Average volume of business and yield per acre for large sugar cane farms in Louisiana, 1937-1949, inclusive 10
2. Average net returns from the production of sugar on large farms in Louisiana, 1937-1949, inclusive 11
3. Costs and returns per acre of cane grown on large sugar cane farms in Louisiana, 3-year averages for 1937 through 1945, annual for 1946-1949 13
4. Three-year period averages, 1937-1945, annual 1946-1949, of costs and returns for large sugar cane farms in Louisiana, per ton of cane sold 15
5. Thirteen-year average costs and returns for large sugar cane farms in Louisiana, 1937 to 1949, inclusive 16
6. Thirteen-year average labor costs for large sugar cane farms, Louisiana, 1937 through 1949, inclusive 16

APPENDIX TABLES

I. Costs and returns per acre of cane grown for large sugar cane farms in Louisiana, 3-year averages 1937 through 1945, annual averages 1946 through 1949, inclusive 26

II. Costs and returns per farm for large sugar cane farms in Louisiana, 3-year averages for 1937 through 1945, annual 1946 through 1949, inclusive 27

III. Costs and returns per ton of cane sold on large sugar cane farms in Louisiana, 3-year averages for 1937 through 1945, annual averages for 1946 through 1949, inclusive 29

IV. Relation between acres in cane per farm and costs and returns on large sugar cane farms in Louisiana, 1946-1949 30

V. Relation between the tons of cane sold per farm and the cost of producing cane on large sugar cane farms in Louisiana, 1946 through 1949, inclusive . . 31

VI. Relation between the tons of cane sold per farm and income from producing cane on large sugar cane farms in Louisiana, 1946 through 1949, inclusive 32

VII. Relation between the yield of cane per acre and the cost of operating large sugar cane farms in Louisiana, 1946 through 1949, inclusive 33

VIII. Relation between yield of cane per acre and the income from large sugar cane farms in Louisiana, 1946 through 1949, inclusive 34

IX. Relation between direct labor costs per ton of cane sold and cost of producing cane on large sugar cane farms in Louisiana, 1946 through 1949, inclusive 35

X. Relation between direct labor costs and income from producing cane on large sugar cane farms in Louisiana, 1946 through 1949, inclusive 35

XI. Geographic variations in the cost and returns from the operations of large sugar cane farms in Louisiana, average per ton of cane sold, for the years 1946 through 1949, inclusive 36

Financial Results of the Operation of Large Sugar Cane Farms in Louisiana, 1937 to 1949

J. Norman Efferson and Mildred Cobb

INTRODUCTION

Detailed studies of the costs and returns from the operation of large sugar cane farms in Louisiana were conducted annually by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station from 1937 through 1949.[1] Each year the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. In most years, records were collected from 70 to 90 large farms. For each year studied the acreage of sugar cane on the farms surveyed comprised from 10 to 20 per cent of the total acreage of sugar cane for sugar in the state of Louisiana.

Louisiana is the leading producer of sugar cane in the nation. The crop is one of the three major farm products of the state and is exceeded in acreage and cash value only by cotton and rice. The sugar cane area is located in the south and southeastern part of the state, mainly in the delta regions adjoining the Mississippi and Atchafalaya Rivers. The farms on which sugar cane is produced may be divided into two general types; one is the "family-type" farm, on which most of the labor in the production of the crop is performed by the farm operator and members of his family; the other is the "large farm," on which substantially all of the labor is hired. The purpose of this report is to present a summary of the financial results of the operation of large sugar cane farms in Louisiana for the 13-year period 1937-49, the detailed annual results for the most recent 4-year period, 1946 through 1949, and to make comparisons of significant trends during the most recent years studied.

PROCEDURE

The farms selected for the sample were chosen on the basis of 10 to 20 per cent of the total cane for sugar acreage of the state, stratified according to the importance of sugar cane in the various sub-areas of the state. Within this stratification, however, the final selection of individual farms in the sample was determined by the degree of cooperation assured by the managers and bookkeepers and the relative accuracy of the records involved. Thus, the average results for each year and for the 13-year period can be considered somewhat better than the averages for the region as a whole, since the most efficient operators are usually the ones who are the most cooperative and keep the best records.

---

[1] *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana, 1937 and 1938* (Louisiana Agricultural Experiment Station Bulletin No. 315, February, 1940); *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana, 1939, 1940, and 1941* (Louisiana Agricultural Experiment Station Bulletin No. 374, March, 1944); and *Financial Results of the Operation of Large Sugar Cane Farms in Louisiana for Nine Years, 1937 to 1945* (Louisiana Agricultural Experiment Station Bulletin No. 419, June, 1947).

The field data were collected by making personal visits to farms to obtain the necessary information from their records. Most of the farms studied had the services of a full-time bookkeeper and employed an outside C.P.A. accounting firm to make a final audit of the results at the end of each season. The basic data used in this study were obtained from the audited reports of each season's operations and from supplementary information of a more detailed nature from the ledger and journal accounts of the individual farm units.

For the most part, identical farms were studied throughout the period. From year to year, some farms were dropped from the sample and others added for various reasons, but at least one-half of the sample included in the most recent year studied, 1949, was included in each of the 13 years.

Items of Cost

The total costs of operating the large sugar cane farms were divided into five main groups with each group subdivided into various items. These groupings were determined largely by the customary practices of the farm managers in keeping their accounts. Since accounting practices varied somewhat between farms, however, it was necessary to make certain adjustments in the accounts of some of the farms in order to fit them into the arrangement used in this study. For some farms it was necessary to make estimates as to the allocation of cost items under the different headings; these estimates were made in all cases by the manager or some other official of the farm unit. Such allocations affect the distribution of costs between items; they do not affect the total cost of any farm.

General Overhead expenses include all items that were not a part of the direct costs of planting, cultivating, and harvesting sugar cane or other crops. Thus this item of expense includes many costs other than those commonly thought of as overhead costs. The reason for this arrangement is that many of the farms did not keep their records in a form that permitted a more detailed summary or breakdown of these so-called overhead costs than that shown. The labor item under general overhead includes both payment for general supervision and maintenance and for the labor used in all farm work of a general nature such as ditching, repairing machinery and fences, and similar jobs. Other items under general overhead include feed purchased, oil, gasoline, grease, and similar farm supplies, taxes, insurance, depreciation, and other miscellaneous costs such as labor transportation, stable expenses, and upkeep of yards and buildings. Most of these items, such as oil, gasoline, and grease, actually were used in direct farm operations in connection with the planting, growing, and harvesting of sugar cane, but because the records were kept in such manner that these and similar items could not be distributed accurately to the specific operations, all such items of cost were included in general overhead expenses. Also, no attempt was made to allocate taxes, insurance, or depreciation to specific groups of costs.

Planting and Cultivating costs include only the direct cash costs of performing these operations on the sugar cane crop. The most important of these is labor. The cost of seed cane does not represent a cash cost, except in a few isolated instances where a small amount of seed was purchased from other growers, since most seed cane planted was obtained from production on the farm. The value of cane used for seed in the fall of the previous year was charged as a cost against the following year's crop, while the value of the cane used for seed in the fall of each year was credited as income for that year. These two items do not balance exactly because of differences in the price and amount of cane planted in the different years. The fertilizer costs include the amount paid for purchased fertilizer applied to the current crop and for seeds used for soil improving crops. Other planting and cultivating costs include expenses for grass and weed control, insect and disease control, and similar items.

Harvesting costs include the direct cash costs incurred in cutting, topping, and stripping the cane and loading and hauling it to the field derricks, at which point the cane is transferred to the control of the mills. Most of these expenses were for labor.

Other Crop expenses include the labor, seed, and fertilizer costs incurred in the production and harvesting of the miscellaneous crops produced on the farm. For the most part, these expenses were incurred in the production of corn and/or soybeans on one-third to one-fourth of the total cropland under the usual three- to four-year rotation, which consists of two or three years in sugar cane and one year in corn and soybeans or soybeans alone.

Interest costs were included as a part of the total costs of operating large sugar cane farms. It was calculated at 5 per cent of the total value of assets used in the business. Interest actually paid by the various farms for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This approach placed all farms on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. The use of the 5 per cent rate in computing interest charges was largely arbitrary. The effect of using a different rate can be determined by applying any desired rate to the capital investment.

MEASURES OF COST AND RETURN

The net cost of producing sugar cane was determined by subtracting miscellaneous credits from the total cost. Miscellaneous credits included the income received by the farm units from sources other than the sale of sugar cane and government payments. This miscellaneous income was received largely from cane used for seed, the sale of crops other than sugar cane, and the sale of livestock and livestock products. The production and sale of these products were, for the most part, merely incidental to the business of producing sugar cane; thus the income from their sale may be regarded as having reduced the cost of producing sugar cane below what it would have been otherwise.

The total income of the farms includes the receipts from the sale of sugar cane and payments received under various governmental assistance programs plus the items accounted for in connection with miscellaneous credits.

Operating expenses include all costs except interest on the capital investment. Net operating income is the difference between total income from all sources and operating expenses. It represents the income available for the payment of interest, dividends, and additions to surplus. Net income is the amount remaining after subtracting interest at the rate of 5 per cent from the net operating income, and represents the net return above all costs including a reasonable charge for the capital invested in the business.

LIMITATIONS OF THE DATA

The audited financial reports furnished by the growers contributed greatly to the accuracy of the data. There are several limitations in the financial reports on which this series of studies was based, however, which should be pointed out for a clearer interpretation of the results.

Several of the large sugar cane planting companies included in this study operated more than one farm unit. For 1937 and 1938, the records available for such units were not in sufficient detail so that each farm unit could be studied separately and, as a result, the data for these two earlier years show a much larger average size of farm and volume of business per farm than similar results for the years after 1938. This is due to the fact that the records for multiple-unit operating companies were grouped as one single farm unit in 1937 and 1938. In 1939 and succeeding years, the records were such that each individual farm unit could be studied separately. Thus, the averages per farm as presented for 1937 and 1938 are not comparable with averages for the other years. The average unit costs and returns, however, were not affected by this difference; and unit costs and returns for the entire series of nine years are directly comparable.

Some of the growers' books were kept on a cash instead of an accrual basis. On the cash basis, receipts and expenditures are recorded when the cash is actually paid or received, rather than charging that expense or crediting that receipt to the particular crop year to which it is applicable. This cash basis of farm accounting results in slight differences in costs and returns for any one year, as compared with the accrual basis, although over a long period of years the result will be the same by either method.

In addition, some of the records did not separate labor and materials in each of the several categories of expense. In most of these cases, where the cost of materials was low, all of the costs were charged to labor. For this reason, labor costs were overstated slightly in some of the expense classifications. Also, some of the records did not record the amount and value of cane used for seed. In these cases, since cane used for seed in the fall preceding the crop year was not charged as an expense, and the seed planted in the current year for the next year's crop not credited as a receipt, the over-all financial picture remained approximately the same. This method of bookkeeping, however, results in a slight error when average yields per acre are computed. When the amount of cane used for seed was unknown, the tons of cane sold were used to compute the yield of cane per acre planted. It is believed that this procedure in part of the records analyzed caused the average yield per acre for all farms to be understated to the extent of about one ton per acre in most years.

The "general overhead" expense item in many cases contained items that would have been charged as direct costs had the various farm records been kept in more detail. With more detailed records, "general overhead" most likely would have been lower, and "planting and cultivating" and "harvesting" costs correspondingly higher.

OTHER CONSIDERATIONS

The method used to compute average interest costs is subject to some limitations but is used in an effort to make interest costs comparable for all farms. The only accurate figure available as to the total assets on the books of most of the farm units studied was the "depreciated assets" item as used for federal and state income tax purposes. Since many of the older farm units have depreciated their assets heavily during the course of time, including some farms with every mule on the place written down to a value of a dollar a head, the capital investment data as used in these studies to compute interest charges are lower than the book value, replacement cost, or sales value of the property. As a result, the interest cost for such farms is much lower than the interest which would have had to be paid if the property were purchased on the open market with the use of borrowed funds.

In interpreting the average operating income before interest and the net income after interest, it should be noted that these two measures of return or profit are the returns *before income taxes,* since no state or federal income taxes are included in any of the cost items. Income taxes were excluded from the items of cost in order to obtain an average cost per farm and per unit of production that would be directly comparable from farm to farm and from year to year. This procedure gives more accurate cost data for comparing farm to farm in any one year or averages over a period of years, but it also overstates the actual profit made by the business and retained by the operator or returned to the stockholders of the farm.

The amount of cane produced by the farms is reported in field tons at the derrick, actual weight for the 1937-45 period and standard tons from 1946 through 1949. For some analysis purposes, the amount in terms of standard tons is more desirable, and this adjustment was made beginning in 1946.

COSTS AND RETURNS

A general summary of the average results for each of the 13 years studied is shown in Tables 1 through 5. A more detailed analysis of the final results for the 3-year periods 1937-39, 1940-42, and 1943-45, and of annual results from 1946 through 1949 is presented in the Appendix.

Volume of Business

The average volume of business for the farms studied each year from 1937 through 1949, including the number of farms, the acreage of sugar cane per farm, the tons of cane sold per farm, and the average yield per acre, is indicated in Table 1. Variations in the volume of business in the 1937-45 period were due to differences in the definition of a farm in the sample, which has been explained previously. From 1946 through 1949, identical farms, for the most part, were included in the study each year, and the average acreage of sugar cane per farm varied from 737 in 1946 to 718 in 1949. Throughout the period of time covered by this series of studies, the acreage of sugar cane in Louisiana has been relatively constant, and most of the variation in total production has been due to changes in yield per acre from year to year because of weather conditions.

Average yields on the farms studied varied from a high point of more than 23 tons per acre in 1938 and 1939 to only 15 tons in 1940 and 1947. For the 13 years studied, the average yield was less than 20 tons in

TABLE 1. Average Volume of Business and Yield Per Acre for Large Sugar Cane Farms in Louisiana, 1937-1949, Inclusive

Year	Number of Farms	Average per farm		
		Acres cane grown	Tons cane sold	Tons cane produced per acre
1937	33	1,465	28,806	21.0
1938	35	1,305	28,465	23.3
1939	88	634	13,587	23.4
1940	89	611	8,290	15.1
1941	76	633	11,489	19.9
1942	52	1,035	18,619	19.3
1943	55	970	18,787	20.5
1944	54	943	18,079	20.3
1945	54	971	20,232	21.9
1946	98	737	12,661	17.7
1947	76	691	9,762	14.6
1948	77	712	12,782	18.6
1949	75	718	13,068	18.2

7 years, varied from 20 to 21.9 tons in 4 years, and was more than 22 tons in only 2 years.

In the earlier years of the period, the average yields on the large sugar cane farms surveyed tended to be equal to or above the yield for the state as a whole. In the later years of the period, and especially from 1946 to 1949, yields on the large farms were lower than the state average. The large sugar cane farms in Louisiana mechanized and adjusted their farming operations to wartime and postwar high labor-cost conditions more rapidly than the family-type producers in the region. This, no doubt, resulted in lower labor costs than otherwise would have been the case, but it also brought about relatively lower yields. In sugar cane production, as in many other agricultural enterprises, mechanization does not increase average yields. Often it results in a decline in yields.

Net Returns Per Farm

The average investment per farm, the net operating income before interest charges, the net income after interest on a per farm basis, and the percentage return on investment before interest costs and taxes for each of the 13 years are shown in Table 2.

Total assets, which represent the depreciated value of all land, buildings, machinery, and equipment used in the operation of these large sugar cane farms, averaged about $155,000 in 1946 but increased to $167,000 in the 1948-49 period. This trend toward an increased investment to operate the same relative volume of business is due to higher replacement costs for machinery, equipment, and building materials.

TABLE 2. Average Net Returns from the Production of Sugar on Large Farms in Louisiana, 1937-1949, Inclusive

Year	Number of farms	Average per farm			
		Total Assets	Net Operating Income	Net Income	Per cent return on assets before taxes*
1937	33	$257,987	$ 4,474	$ − 8,425	1.73
1938	35	233,658	4,155	− 8,368	1.78
1939	88	126,177	9,727	+ 3,418	7.71
1940	89	104,170	− 7,434	−12,644	− 7.14
1941	76	132,402	2,225	− 4,395	1.68
1942	52	173,006	19,520	+10,869	11.28
1943	55	172,774	23,098	+14,459	13.37
1944	54	167,377	20,176	+11,807	12.05
1945	55	191,758	33,488	+23,900	17.46
1946	98	155,416	14,325	+ 6,554	9.22
1947	76	160,102	− 655	− 8,660	− 0.41
1948	77	167,887	− 602	− 8,997	− 0.36
1949	75	166,257	+ 5,897	− 2,412	3.55

*Computed by dividing the net operating income by the total assets. Since the net operating income does not include a deduction for actual interest paid or for computed interest costs, this return overstates the actual return by the amount actually paid as interest on borrowed funds.

This trend can be expected to continue for the next few years as the general movement of most farm expenses is upward.

The net operating income, or the excess of receipts over expenses, other than interest and income taxes, varied from a loss of more than $7,000 per farm in 1940 to a gain of about $33,000 per farm in 1945. In 6 of the 13 years, the net operating income was less than $5,000 per farm; in 3 years, it varied from $5,000 to $15,000 per farm; and in 4 years the average net operating income was more than $15,000 per farm. In 2 of the last 4 years studied, however, there was a net loss for the year and the average net operating income for 1949, the most recent year studied, was $5,897 per farm. Net returns in the 4-year postwar period were much lower than during the 4 war years.

In terms of the percentage return on the capital investment, this net operating income amounted to a loss of 12 per cent in 1940 and about one-half per cent in 1947 and 1948, a gain of less than 2 per cent in 3 other years, a gain of from 3 to 9 per cent in 3 years, and of more than 10 per cent in 4 years. As was indicated in the earlier years of these studies, there was no stability of average earnings in the production of sugar cane on large farms in Louisiana. They made either reasonably good earnings or unreasonably large losses. These facts reemphasize the fallacy of attempting to make policy decisions regarding this industry on the basis of results of the previous year only. In attempting to forecast what is likely to happen in the future, there appears to be only one assured factor. Next year, things will definitely be different from conditions in the previous past year. A long period of results of past years does give some indication as to possibilities for any equally long period in the future, but not for any one year as compared with another. This situation is due to the fact that net returns are determined largely by the average yields obtained. These yields in turn are determined by weather conditions, which are impossible to forecast.

The variation in net returns in the production of sugar cane from year to year is indicated more clearly by the differences in average net income, or the excess of receipts over expenses plus a charge of 5 per cent to cover all interest costs. The average net income of the farms studied varied from a loss of more than $12,000 per farm in 1940 and around $9,000 per farm in 1947 and 1948 to a gain of $24,000 in 1945. In 6 of the 13 years, returns were sufficiently high to bring more than 5 per cent on the capital investment. In the other 7 years, net returns were less than 5 per cent of the depreciated capital investment, including 3 years in which no return was made on capital.

Costs and Returns Per Acre

A summary of the average costs and returns per acre of sugar cane for the farms studied in terms of 3-year averages for the 1937-39, 1940-42, and 1943-45 periods and annual data from 1946 through 1949 is presented in Table 3. A more detailed outline of the unit costs per acre for each period is summarized in the Appendix.

Total costs per acre of sugar cane averaged about $90 in the 1937-39 prewar period but increased gradually during the war and early postwar years to reach a high point of more than $146 per acre in 1948. In 1949, total costs per acre were slightly lower than in 1948, averaging $136. The long-time trend toward increasing costs per acre of sugar cane during the 13-year period was due to increased expenses for general overhead including machinery, labor, and materials, and increased costs for planting and cultivating because of advancing wage rates. Costs for harvesting, including only direct labor and transportation to the derrick, increased from about $20 per acre in the prewar period to around $25 per acre in the 1947-49 period. Because of relatively high wage rates and an acute shortage of man labor, most of these farms mechanized their harvesting operations during the 1945-49 period. They substituted machinery (included in overhead costs) for direct labor in harvesting. As a result, direct harvesting costs show little change during the period, while overhead costs were almost twice as high in 1949 as in 1937.

The net cost per acre varied to about the same extent as total costs. Miscellaneous credits, which were subtracted from total costs to obtain

TABLE 3. COSTS AND RETURNS PER ACRE OF CANE GROWN ON LARGE SUGAR CANE FARMS IN LOUISIANA, 3-YEAR AVERAGES FOR 1937 THROUGH 1945, ANNUAL FOR 1946-1949

Items of cost and return	Per acre cane grown						
	3-year averages			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Expenses—							
General overhead	36.68	37.64	55.60	63.35	66.73	63.68	59.31
Planting and cultivating	21.18	21.53	25.67	30.53	36.46	40.65	38.20
Harvesting cane	20.56	12.94	20.97	20.90	24.67	26.34	23.95
Other crops	2.90	3.89	4.33	2.90	3.68	3.24	2.54
Interest	9.45	9.13	9.22	10.55	11.59	11.79	11.57
Total cost	90.77	85.13	115.79	128.23	143.13	145.70	135.57
Miscellaneous credits	9.48	8.47	9.50	6.94	11.69	9.60	8.39
Net cost	81.29	76.66	106.29	121.29	131.44	136.10	127.18
Receipts—							
Cane sold	59.60	56.10	90.14	108.21	95.35	103.61	105.55
Government payments	19.43	14.82	33.50	19.73	18.12	19.15	18.27
Molasses bonus	.....	.....	.....	2.25	5.43	.70	.....
Miscellaneous credits	9.48	8.47	9.50	6.94	11.69	9.60	8.39
Total income	88.51	79.39	133.14	137.13	130.59	133.06	132.21
Operating expenses	81.32	76.00	106.57	117.68	131.54	133.91	124.00
Net operating income	7.19	3.39	26.57	19.45	− .95	− .85	8.21
Net income	−2.26	−5.74	17.35	8.90	−12.54	−12.64	− 3.36
Capital investment	184.70	182.45	184.36	210.99	231.80	235.88	231.57
Cane sold	21.41	16.57	19.78	17.70	14.60	18.55	18.20

net costs, varied little, averaging about $9 per acre of cane grown in 1937 and $8 per acre in 1949. Net costs per acre varied from $81 per acre in 1937 to $127 in 1949, or an increase of about 60 per cent.

Income from sugar cane sales also increased during the 13-year period, varying from $60 per acre in the 1937-39 period to a high point of $108 in 1946. After 1946, income from sugar cane declined and varied from $95 in 1947 to $106 per acre in 1949. Returns from government conditional payments remained about the same throughout the period.

The average net operating income per acre, or the return to the operator to pay for management and interest on the investment, varied from $7 per acre in the 1937-39 period to a high point of $27 per acre in the 1943-45 period. In the most recent 4-year period, 1946-49, the net operating income declined greatly from wartime levels. In both 1947 and 1948, there was a net operating loss while the operating income per acre in 1949 was $8 per acre. The net income per acre, after deducting a 5 per cent interest charge on the capital investment, declined from a high point of $17 per acre in the 1943-45 period to $9 in 1946 and to a net loss varying from $13 to $3 per acre in the 1947-49 period.

Costs and Returns Per Ton

A summary of the average costs and returns per ton of sugar cane sold for the farms studied in terms of 3-year averages from 1937 through 1945 and annual data from 1946 through 1949 is presented in Table 4. A more detailed outline of the unit costs per ton for each period is summarized in the Appendix.

Total costs per ton sold varied from about $4 in the 1937-39 prewar period to more than $10 per ton in 1947. On a per ton basis, costs were unusually high in 1947 because of a partial crop failure resulting in low yields. Comparing the 1937-39 period with the most recent year studied, 1949, total costs per ton were about double costs in the earlier period. Total receipts also increased from 1937 to 1947, but declined after that time. Gross receipts per ton increased from $4.23 in the prewar period to $9.24 in 1947, and then declined to $7.26 per ton in 1949.

These unit returns per ton of cane sold vary slightly from the official average prices reported in some of the years studied; this difference is due to the fact that the official prices are quoted in terms of standard tons, while this analysis is made on the basis of actual field tons as delivered to the derrick. Also, owing to the accounting differences mentioned heretofore, the average government payments in some years vary from those announced for a particular crop season.

The net income per ton of cane sold varied from a high point of $0.87 for the 1943-45 period to a net loss of more than $1.00 per ton in 1940 and smaller net losses in the 1947-49 period. The capital investment per ton of sugar cane produced increased from about $9 in the prewar period to about $13 in the 1948-49 period. This increased capital required to produce a ton of sugar cane was caused mostly by additional purchases of machinery and equipment which were used to offset rapidly increasing wage rates.

TABLE 4. Three-Year Period Averages, 1937-1945, Annual 1946-1949, of Costs and Returns for Large Sugar Cane Farms in Louisiana, Per Ton of Cane Sold

Items of cost and return	Dollars per ton of cane sold						
	3-year average			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
General overhead	1.76	2.29	2.80	3.69	4.72	3.55	3.26
Planting and cultivating	1.01	1.32	1.30	1.78	2.58	2.26	2.10
Harvesting cane	.98	.78	1.06	1.22	1.75	1.47	1.32
Other crops	.14	.24	.22	.16	.26	.18	.13
Interest	.45	.55	.46	.61	.82	.65	.64
Total costs	4.34	5.18	5.84	7.46	10.13	8.11	7.45
Miscellaneous credits	.45	.51	.48	.40	.83	.53	.46
Net costs	3.89	4.67	5.36	7.06	9.30	7.58	6.99
Receipts from cane	2.85	3.33	4.56	6.30	6.75	5.77	5.80
Government payments	.93	.90	1.67	1.15	1.28	1.07	1.00
Molasses payments	....	....	....	.13	.38	.04	....
Other receipts	.45	.51	.48	.40	.83	.53	.41
Total receipts	4.23	4.74	6.71	7.98	9.24	7.41	7.26
Operating expenses	3.89	4.63	5.38	6.85	9.31	7.46	6.81
Net operating income	.34	.11	1.33	1.13	−.07	−.05	.45
Net income	−.11	−.44	.87	.52	−.89	−.70	−.19
Capital investment	8.82	11.12	9.31	12.28	16.40	13.13	12.72

Thirteen-Year Average Costs and Returns

A summary of the average costs, returns, and net profit for the entire 13-year period, 1937 through 1949, is shown in Table 5. These data are computed on the basis of a simple average of the results for each year. For the 13 years, an average of 66 farms per year were surveyed. These farms had an average volume of business of 917 acres of sugar cane and sold 16,504 tons of sugar cane annually. The 13-year average yield in terms of cane sold per acre amounted to about 18 tons.

For the entire period, the farms studied produced sugar cane at an average cost of $104 per acre, or $5.76 per ton sold. Of this amount, 45 per cent was general and overhead costs, 24 per cent was direct planting and cultivating costs, 19 per cent went for direct harvesting expenses, 3 per cent for costs of growing other crops, and 9 per cent for interest.

On the basis of the type of expense, $2.91 per ton, or 51 per cent of the total costs, was composed of direct payments to hired labor. Direct labor costs amounted to an average of $0.95 per ton for general overhead,

$0.87 per ton for planting and cultivating cane, $0.99 per ton for harvesting, and $0.10 per ton for costs of other crops (Table 6).

During the 13-year period, 1937-49, more than one-half of the total costs of producing sugar cane on these large sugar cane farms in Louisiana was composed of wages and salaries for labor. In addition, there were other indirect labor charges included in the repair of machinery and similar items. The average gross income for the 13-year period

TABLE 5. THIRTEEN-YEAR AVERAGE COSTS AND RETURNS FOR LARGE SUGAR CANE FARMS IN LOUISIANA, 1937 TO 1949, INCLUSIVE

Item	Per farm	Per acre grown	Per ton cane sold
	Dollars	Dollars	Dollars
General overhead	42,756.83	46.63	2.59
Planting and cultivating	23,091.89	25.18	1.40
Harvesting cane	17,683.42	19.28	1.07
Other crops	2,945.62	3.21	.18
Interest	8,560.41	9.34	.52
Total costs	95,038.18	103.64	5.76
Miscellaneous credits	8,037.09	8.76	.49
Net cost	87,001.09	94.88	5.27
Receipts from cane	68,611.34	74.82	4.16
Government payments	19,251.48	20.99	1.17
Molasses bonus	454.20	.50	.02
Other receipts	8,037.09	8.76	.49
Total receipts	96,354.11	105.07	5.84
Operating expenses	86,477.76	94.30	5.24
Net operating income	9,876.35	10.77	.60
Net income	1,315.93	1.43	.08
Capital investment	169,920.88	185.30	10.30
Cane sold	16,504	17.9	
Acres cane grown	917		.56
Average number farms per year	66		

TABLE 6. THIRTEEN-YEAR AVERAGE LABOR COSTS FOR LARGE SUGAR CANE FARMS, LOUISIANA, 1937 THROUGH 1949, INCLUSIVE

Item	Per farm	Per acre cane grown	Per ton cane sold
	Dollars	Dollars	Dollars
General overhead	15,664.99	17.08	.95
Planting and cultivating	14,330.68	15.63	.87
Harvesting cane	16,405.81	17.89	.99
Other crops	1,627.57	1.77	.10
Total	48,029.05	52.38	2.91

amounted to $105 per acre, or $5.84 per ton sold, annually. Of this amount, $4.16 per ton, or 71 per cent, was income from the sale of sugar cane, $1.17 per ton, or 20 per cent, was conditional payments, and the remaining 9 per cent was income from miscellaneous sources.

The net operating income, or the amount remaining to pay interest, income taxes, dividends, and additions to capital, averaged about $10,000 per farm annually, $11 per acre, or $.60 per ton of cane sold. After deducting interest charges, the net income averaged $1,316 per farm per year, $1.45 per acre of cane grown, or $0.08 per ton of cane sold.

The average capital investment amounted to about $170,000 per farm. If it were assumed that every farm owner owned all his farm outright and paid no interest charges on any of the capital, the net operating income for the 13-year period would represent 5.8 per cent per year on the capital investment. From this return would have to come the actual interest paid on borrowed funds, income taxes, and capital replacements to the extent that depreciation rates on old equipment were not sufficient for replacements, before the remainder could be considered net earnings to the investor. In view of the risky nature of the business of sugar cane farming, the net operating return of 5.8 per cent on the investment and the net income of less than 1 per cent on the investment cannot be considered very good returns.

FACTORS AFFECTING COSTS AND RETURNS

The unit costs and returns and the profits or losses per farm in the operation of large sugar cane farms in Louisiana are affected by a great number of different factors, some under the control of the management and many beyond control of the individual operators. In this state, the major factors determining the costs and returns from the production of sugar cane on large farms are indicated to be the annual variations in the size of the crop, which is determined more by the weather than by the acreage planted, since the acreage has been relatively stable from year to year; the kind of prevailing weather during the harvesting season and the presence or absence of damaging frosts; the sucrose content per ton of cane harvested, which is determined in the short run by the weather and other factors such as the amount of tops, trash, etc.; and the price received for sugar cane, which is based on the usual cane-purchase contract according to the price of raw sugar. The favorable or unfavorable effect of the first three of these four important factors is dependent, in any one year, on the weather, which is not predictable. The favorable or unfavorable effect of the last factor, the price of sugar cane, is dependent on raw sugar prices, which are established at national and international levels.

Because sugar supplies produced in Louisiana make up only about 7 per cent of normal consumption requirements in the United States, the Louisiana sugar production has little effect on sugar supplies for the nation as a whole; therefore, producers in this state do not have the advantage held by some agricultural areas of a short crop usually being accompanied by a compensating high price. For this reason, historical price trends indicate that a short crop is just as likely to be accompanied by a relatively low price as by a high price.

These factors indicate the great dependence of this phase of the sugar cane industry on factors which cannot be foreseen in advance and which determine to a large extent the relative profits from the production of sugar cane. Actually, the most important factor determining the success or failure of an individual farm operator of a large sugar cane farm in Louisiana is whether or not he was fortunate enough to start in the business at a time when the many uncontrollable factors were favorable to good returns. If he came into the business during a period of relative stability of prices and costs and fairly favorable weather conditions, he made good net returns—large profits if he was a good manager, but still a net return even if he was a poor manager. If he came into the business at a time of relatively high costs compared with returns and had a bad year or two at the start because of unfavorable weather conditions and/or losses due to frosts, he sustained net losses. And usually, the better manager he was, the more he lost, on the same basis that during the war years the businessman who followed sound business practices and maintained a rapid inventory turnover earned less than his competitor who was less diligent and who received the advantage of every price increase because he did not have a rapid inventory turnover. On large sugar cane farms, the general tendency for higher earnings to be made in the good years and higher losses in the bad years by the efficient operators as compared with the less efficient ones, appears to hold true as it does in many other types of industries.

The financial results of the Louisiana studies of large sugar cane farms show, however, that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. It follows, then, that there are still other reasons for variations in returns in addition to the major ones listed previously. These factors causing one large farm to have lower costs and higher returns than another in the same area and in the same year are both physical and economic in character. The physical factors include selection of varieties, disease and insect control, methods of planting, cultivating, fertilizing, harvesting, and many others. Since this series of studies has been limited to a statistical analysis of the final results each year, no attempt has been made to study these physical and internal-management problems of the large sugar cane farms, although it is recognized that differences do exist and that these variations cause much of the final difference in costs.

From the annual statistical analysis of large sugar cane farms in Louisiana the economic factors that were found to be important in affecting costs, returns, and net profits are as follows: size of farm, yield per acre, labor efficiency, and proportion of cropland planted to cane.

Size of Farm

The average size of the large sugar cane farms studied in Louisiana for the 13-year period was about 2,500 acres, including about 1,500 acres in cropland and the remainder in swamp or poorly-drained land, woods, building sites, roads, and ditches. Of the total cropland, about 900 acres per farm were planted to sugar cane, 500 acres planted to corn and/or soybeans, and 100 acres in other crops or idle cropland. Of the land planted in sugar cane, the usual proportion was about 40 to 45 per cent in plant cane, 40 to 45 per cent in first-year stubble cane, and 10 to 20 per cent in second-year stubble. An average farm of this size required a total investment in land, buildings, workstock, and equipment of about $170,000.

Although all of the farms included in the Louisiana series of studies of large sugar cane farms were corporate-sized units, variations in size did exist even in this group. Some of the farms studied had less than 500 acres in cropland, less than 250 acres in sugar cane, and sold less than 5,000 tons of cane per farm per year. Others had more than 2,000 acres in cropland, more than 1,000 acres in sugar cane, and average annual sales of more than 20,000 tons of sugar cane per farm. The relationship of size of farm to costs and returns for the farms studied from 1946 to 1949 is shown in Appendix Tables V through VIII.

There are many measures that are used commonly to indicate the size of a farm. The most familiar and common one is the total acreage in the entire farm. For Louisiana sugar cane farms, the varying relative amounts of woods and swamp on the different farms make this measure undesirable since two farms of the same total acreage may have widely different amounts of cropland and land in cane. Total cropland also is used occasionally; on the farms studied, varying amounts of idle cropland made the use of this measure questionable. The two best measures of size of business of the large sugar cane farms appeared to be the acreage of sugar cane per farm and the volume of sugar cane sold per farm. The analysis of size in relation to costs and returns as presented in Appendix Tables IV through VI is based on these two measures.

In contrast to the results from the studies of family-type sugar cane farms in Louisiana, the larger farms in the corporate-type farms studied did not have the lowest unit costs and the highest net returns.

In the 1937-45 phase of these studies, the group of farms with 1,000 to 1,500 acres in cropland, of which 500 to 1,000 acres were planted in sugar cane, and with sales of 10 to 20 thousand tons of cane annually had lower unit costs and made higher unit returns than did the smaller farms with less than 500 acres in sugar cane or the larger sized group with more than 1,000 acres in cane. This same relationship was indicated for most of the 1946-49 period.

For some years, however, this general relationship did not hold true. Although in 9 of the 13 years studied, the moderately large corporate-type farms (500 to 1,000 acres of sugar cane per farm) had lower costs per unit and made greater net returns per ton than the larger or the smaller farms, in the remaining 4 years, the fairly small corporate-type farms, with about 250 to 500 acres in sugar cane, had the highest net returns or the lowest losses.

The years in which this relationship occurred were relatively unfavorable years for the group as a whole. In general, the tendency appeared to be for the moderately large corporate-type sugar cane farms to make higher earnings in good years and larger losses per unit in bad years than the relatively small farms of this type and to make higher net earnings per unit in good years and lower losses in bad years than were made by the extremely large farms of this type.

On family-sized sugar cane farms, the advantage of better utilization of the available unpaid family labor which otherwise would have been idle is such that the larger the size of the farm, so long as it remained a family-sized unit, the greater were the returns in most years. For the large corporate-type farms, however, this advantage of full utilization of unpaid labor does not exist, since all of the labor is hired on an hour basis; therefore, the point of diminishing returns appears to have been reached at a size of about 1,000 acres in cane and 1,500 acres in cropland. The data indicate that increased efficiency on these large farms was obtained with increased size up to this point; but beyond this point, increased size appeared to result in higher costs and lower returns rather than increased efficiency.

Yields Per Acre

Farm management studies throughout the United States have shown that within the actual practices of farmers, the higher the crop yields, the higher are the returns from farming. Farms with high yields pay higher returns in depression periods as well as in normal or favorable times. Also, good yields of crops and high production rates for animals are the most important factors in obtaining low costs of production. Farmers with high yields have lower costs per unit and make higher returns per hour of labor and per unit of investment than farmers with lower production efficiency.

For large sugar cane farms in Louisiana, the most important single factor influencing the financial success or failure of the group of farms studied each year was the yield of cane obtained per acre. Stated simply, in any year the farms with relatively high yields brought greater net returns than did the farms with relatively low yields. The relationship of cane yields to costs and returns on the farms studied for the 1945-49 period is shown in Appendix Tables VII and VIII.

Although yields per acre for the area as a whole varied from year to year, in each year some of the farms studied made higher than average yields while others had below-average yields. Throughout the 13-year period studied, the farms with the higher yields had lower costs per unit and higher net returns than those with low yields per acre. For 1949, the most recent year studied, the 23 farms averaging less than 16 tons of cane per acre had total costs of $7.54 per ton and a net loss of $1.06 per ton. In the same year, the 9 farms obtaining yields of more than 22 tons per acre had total costs of $6.54 per ton and a net profit of $0.86. Similar results are indicated for all of the other years from 1937 through 1949.

Variations in yield of cane per acre from year to year are caused primarily by the weather. Differences in yields from farm to farm in the same year, however, are due partly to variations in weather and soils in different parts of the cane area but are caused also by many other factors. It has not been possible to measure in this series of statistical studies of large farms the relative importance of these factors. No doubt some are beyond the control of the individuals operating the farms, but others are largely under the control of the management. For instance, variations in yield resulting from differences in the application of fertilizer, in the use of cover crops, in the selection of varieties, in the control of cane borers, and in planting and cultivating practices are largely under the control of the farm managers, while differences in soil cannot be controlled by management. It is apparent that a considerable part of the differences in yield from farm to farm in any one year is due to factors under the control of the farm operators. If this is true, producers now obtaining low yields should give serious consideration to ways and means of improving their yields.

In a normal year with a 20 to 22 ton per acre yield for the state as a whole, managers of large sugar cane farms obtaining an average yield per acre on their entire production of from 1 to 5 tons lower than the state average can expect their unit costs to be about 10 per cent higher than on the farms where the state average yields are obtained; those making an average yield for their entire production of from 1 to 5 tons more per acre than the state average can expect their unit costs to be about 10 per cent lower than the farms obtaining average yields and 20 per cent lower than those on which the yields are below average.

Efficiency in the Use of Man Labor

Efficiency in the use of man labor refers to the amount of productive work accomplished per man on the farm; in general, the more work accomplished per man, the greater are the profits. Relatively high labor efficiency is especially important in periods of high prices or in areas of high labor costs. In such cases, labor must be efficiently used because of the higher costs.

Direct labor costs comprised about one-half of the total expenses in producing sugar cane during the 1937 to 1949 period. Because labor costs comprised such a large part of the total expenses on these farms, the efficiency with which labor was used was one of the important factors determining the relative financial returns from farm to farm. Because of the nature of this series of studies and the type of records available, no physical measure of labor efficiency was available. Thus, a financial measure of labor efficiency, the direct labor costs per ton of cane sold, was used for analysis purposes. The relation of direct labor expenses to costs and returns on the farms studied from 1946 through 1949 is shown in Appendix Tables IX and X.

In general, the lower the direct labor costs per ton of cane sold, the lower were the total costs of producing cane and the higher the net income per unit. In 1949, for instance, the 23 farms with average direct labor costs of less than $2.20 per ton of cane sold had total costs of only $6.22 per ton and an average net income of $0.48 per ton sold. The 30 farms with direct labor costs of $2.80 per ton or more had total expenses of $9.25 per ton and an average net loss of $1.52 per ton of cane sold.

The size of business and the degree of mechanization appeared to be somewhat interrelated with labor costs on the large sugar cane farms studied. The farms with the lowest labor costs were, on the average, the larger farms with a higher degree of mechanization. Also, as direct labor costs per ton increased, the yield per acre of cane declined. The yield per acre in this case was at least partly the causal factor, since the farms with higher yields were able to utilize labor more efficiently than those with lower yields.

Proportion of Cropland Planted to Cane

There are very few cases in agriculture where one product is so well adapted to an area and where other agricultural products cannot be produced on a large-scale commercial basis, so that the specialized production of that one product justifies complete dependence on it for the cash farm income. For the most part, however, the Louisiana sugar cane area appears to be one of these rare cases.

Although the area appears fairly well adapted from a standpoint of climate and soil conditions to the production of a large number of different farm products, none thus far have become serious competitors of sugar cane. Because of the lack of market outlets for any large volume of certain seasonal truck crops, the abundant rainfall which is desirable for sugar cane but not for most other crops, and the lack of low-cost pasture lands essential to the production of certain commodities such as beef and dairy products, there appear to be few, if any, enterprises which can be used to supplement sugar cane production on a large scale.

The Louisiana sugar cane studies from 1937 to 1949 show that not only on the fairly efficient family-sized farms, but also on the large sugar cane farms, the larger the percentage of the total acreage planted to sugar cane and the smaller the dependence on other sources of income, the lower were the costs of producing cane and the greater were the total profits from the farm business. On the farms studied, the units planting from 60 to 65 per cent of their total cropland in sugar cane usually had lower costs and higher returns from sugar cane and from the entire farm business than those units where less than 60 per cent of the total available land was planted to cane.

There were some exceptions to this general rule. On the large sugar cane farms that had large areas of land that were unsuitable for sugar cane because of soil type, drainage, or other factors, the addition of enterprises to utilize this otherwise idle resource resulted in larger returns from the entire farm business. The most common enterprise of this type was beef cattle.

Geographic Variations

There are sufficient variations in the soil, climate, and other factors affecting the production of sugar cane in Louisiana to produce significant differences in the costs of producing sugar cane in different parts of the region. In an effort to measure some of these variations in costs and returns in different parts of the area, the territory was divided into three regions. One of these, the Lafourche region, included the farms that were situated along Bayou Lafourche in the central part of the Louisiana sugar cane area. The Teche region included all of the farms west of the Atchafalaya river and represents the western side of the cane belt. The Mississippi region included the farms that were located along the Mississippi river on the eastern side of the Louisiana sugar cane area. The average costs, returns, net incomes per unit, and physical characteristics of the farms studied in each of the three areas from 1946 to 1949 are shown in Appendix Table IX. It is recognized that conditions vary significantly within each of these regions, but the number of farms studied was not large enough to warrant any further subdivision.

In terms of net returns per unit, the Teche region had a slight advantage over the other two areas for the entire 13-year period, while the Lafourche area appeared to have averaged somewhat lower net returns over the same period. For the entire period, the Teche region had the highest average net return per unit in 6 of the 13 years and was lowest in only 3 years. The Mississippi region had the highest average net returns per ton in 3 years but had the lowest net return in 4 years. The Lafourche area made the highest average net returns per ton of all areas in 4 years but was lowest in 6 of the 13 years studied.

In the earlier years of the study, from 1937 through 1945, the farms studied in the Lafourche area were somewhat larger in size and obtained slightly lower average yields per acre than was true in the other regions. From 1946 through 1949, however, the yield per acre was lowest in 3 of the 4 years in the Teche region, while average size of farm was approximately the same in all sections.

These facts indicate that variations do exist within the Louisiana sugar cane area, that differences do occur in yields, costs, and returns from one area to another in the same year, but that these differences show no trend or central tendency to indicate that one area is far superior to another over a long period of time.

SUMMARY

1. Detailed studies of the costs and returns from the operation of large sugar cane farms in Louisiana have been conducted annually since 1937 by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station. This report summarizes the detailed results of these studies for the 1945-49 period with comparisons for the entire 13-year period.

2. Records were collected from 70 to 90 large farms in most years. For the entire period studied, the acreage of sugar cane on the farms surveyed represented from 10 to 20 per cent of the total sugar cane area of the state.

3. All statistical and financial data were obtained from the audited statements of the cooperating companies and individuals. Because of variations in bookkeeping practices, it was necessary to make some adjustments in the records of some farms in order to keep all records on a comparable basis. These allocations affected the distribution of costs between items to some extent but did not affect the total costs on any one farm.

4. The average size of the large sugar cane farms studied for the 13-year period was about 2,500 acres, including 1,500 acres in cropland of which about 900 acres were planted to sugar cane. An average farm of this size required a total investment in land, buildings, workstock, and equipment of about $170,000, in the 1946-49 period.

5. Average yields of sugar cane on the farms studied varied from a high point of more than 23 tons per acre in 1938 and 1939 to only 15 tons in 1940 and 1947. For the 13 years studied, the average yield was less than 20 tons in 7 years, varied from 21 to 22 tons in 4 years, and was more than 22 tons in only 2 years.

6. The average net income from the production of sugar cane on these farms, or the excess of receipts over expenses plus interest charges, varied from a loss of more than $12,000 per farm in 1940 and a loss of around $9,000 per farm in 1947 and 1948 to a gain of more than $24,000 in 1945. In 6 of the 13 years, returns were sufficiently high to produce more than 5 per cent on the capital investment. In the other 7 years, net returns were less than 5 per cent of the depreciated capital investment, including 3 years in which no return was made on capital.

7. Unit costs averaged about $90 per acre, or $4.00 per ton of cane sold, in the 1937-39 period but increased gradually during the war and immediate postwar years to reach a peak of about $140 per acre, or $9.00 per ton for the 1946-49 period. Expense items increasing most rapidly during the period were direct labor costs and costs for machinery and equipment.

8. For the entire 13-year period, the farms studied produced sugar cane at an average cost of $104 per acre, or $5.76 per ton of cane sold. Of this total, 51 per cent was for direct payments to hired labor. These producers received an average gross income for the period of $105 per

acre annually, or $5.84 per ton. The resulting net income amounted to $1,316 per farm annually, or $1.45 per acre of cane grown.

9. If it were assumed that every farm owner owned all his farm outright and had no interest costs on any of his capital investment, the annual net operating income for the 13-year period would amount to 5.8 per cent of the capital investment. From this amount would have to come actual interest on borrowed funds, income taxes, and capital replacements to the extent that depreciation rates were not sufficient for replacements. After these deductions, the remainder could be considered net earnings to the operator. In view of the risky nature of this business, such returns have not been high.

10. The financial results of this series of studies of large sugar cane farms show that in any given year and under the same climatic conditions and the same price structure, there are still variations from farm to farm in costs, returns, and net profits. The major factors influencing net returns were found to be the size of the farm, the yield of cane per acre, efficiency in the use of man labor, the proportion of the cropland planted to cane, and geographic differences in location of the farms.

11. In contrast to the results from studies of family-type sugar cane farms, the larger units of the corporate-type farms studied did not have the lowest unit costs and the highest net returns. In general, the tendency appeared to be for the moderately large corporate-type farms to make higher returns in good years and larger losses per unit in bad years than the relatively small farms of this type and to make higher net returns in good years and lower losses in bad years than the extremely large farms of this group.

12. The most important single factor influencing the financial success of the farms studied was the yield of cane obtained per acre. In all 13 years, the farms with relatively high yields brought greater net returns than the farms with relatively low yields.

13. In general, the lower the direct labor costs per ton of cane sold, the lower were the total costs of producing cane and the higher the net income per unit. Labor efficiency on the farms studied appeared to be interrelated with the degree of mechanization and the size of the farms.

14. The analysis indicates that on these large sugar cane farms, the larger the percentage of the total acreage planted to cane and the smaller the dependence on other sources of income, the lower were the costs of producing cane and the greater were the total profits from the farm business.

15. A comparison of costs and returns according to geographic variations indicates that differences do occur in yields, costs, and returns from one area to another in any one year but that these variations show no trend or central tendency to indicate that one area is superior to other regions over a long period of time.

APPENDIX TABLE I. Costs and Returns Per Acre of Cane Grown for Large Sugar Cane Farms in Louisiana, 3-Year Averages 1937 Through 1945, Annual Averages 1946 Through 1949, Inclusive

Items of cost and return	Per acre of cane grown						
	3-year average			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
General overhead—							
Labor	14.07	14.95	19.47	21.20	23.86	22.16	21.11
Feed purchased	2.51	1.84	4.73	2.26	1.04	1.04	.60
Materials	4.26	2.40	8.22	13.49	13.74	13.36	12.89
Oil, gas and grease	2.57	2.34	5.46	4.65	3.00	3.87	3.40
Taxes	2.53	2.66	2.16	2.36	2.68	2.57	2.70
Insurance	.92	1.00	1.13	1.65	2.13	2.00	1.87
Depreciation	5.58	5.43	7.03	8.60	9.75	10.13	10.01
Other	4.23	7.02	7.41	9.05	10.53	8.55	6.73
Total	36.67	37.64	55.61	63.35	66.73	63.68	59.31
Planting, cultivating—							
Labor	13.16	13.75	15.75	19.90	22.45	24.34	23.26
Seed cane	4.70	3.73	3.49	2.19	3.47	4.45	4.06
Fertilizer	2.82	3.52	5.39	5.35	6.90	7.90	7.14
Other	.50	.53	1.04	3.09	3.64	3.96	3.74
Total	21.18	21.53	25.67	30.53	36.46	40.65	38.20
Harvesting cane—							
Labor	20.22	12.20	19.76	18.29	21.32	22.29	19.26
Other	.35	.74	1.21	2.61	3.35	4.05	4.69
Total	20.57	12.94	20.97	20.90	24.67	26.34	23.95
Other crops—							
Labor	*	2.40	2.84	1.95	2.50	2.10	1.34
Seed	*	.56	.95	.46	.56	.47	.41
Fertilizer	*	.38	.38	.24	.14	.17	.11
Other	*	.55	.16	.25	.48	.50	.41
Total	2.90	3.89	4.33	2.90	3.68	3.24	2.54†
Interest	9.45	9.13	9.22	10.55	11.59	11.79	11.57
Total cost	90.77	85.13	115.80	128.23	143.13	145.70	135.57
Miscellaneous credits	9.48	8.47	9.50	6.94	11.69	9.60	8.39
Net cost	81.29	76.66	106.30	121.29	131.44	136.10	127.18
Source of receipts—							
Cane sales	59.60	56.10	90.14	108.21	95.35	103.61	105.55
Government payments	19.43	14.82	33.50	19.73	18.12	19.15	18.27
Molasses bonus	.....	.....	.....	2.25	5.43	.70	.....
Total	79.03	70.92	123.64	130.19	118.90	123.46	123.82
Miscellaneous receipts—							
Cane for seed	3.49	4.12	3.43	3.06	5.13	3.89	3.67
Other crops sold	.97	2.38	2.86	.76	1.32	1.41	.54
Livestock products sold	.12	.27	.20	.23	.34	.15	.05
Other	2.07	1.70	3.01	2.89	4.90	4.15	4.13
Total	9.48‡	8.47	9.50	6.94	11.69	9.60	8.39
Total receipts	88.51	79.39	133.14	137.13	130.59	133.06	132.21
Operating expenses	81.32	76.00	106.58	117.68	131.54	133.91	124.00
Net operating income	7.19	3.39	26.56	19.45	− .95	− .85	8.21
Net income	−2.26	−5.74	17.34	8.90	−12.54	−12.64	−3.36
Capital investment	184.70	182.45	184.36	210.99	231.80	235.88	231.57
Cane sold—tons	21.6	16.6	19.8	17.7	14.6	18.6	18.2

*Not recorded for 1937; not broken down for 1938.

†"Other crops" for 1949 not broken down.

‡Figures in 1937 for "miscellaneous receipts" not broken down into units.

APPENDIX TABLE II. Costs and Returns Per Farm for Large Sugar Cane Farms in Louisiana, 3-Year Averages for 1937 Through 1945, Annual 1946 Through 1949, Inclusive

Items of cost and return	Average per farm						
	3-year average			Annual			
	1937-39	1940-42	1943-45	1946†	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
General overhead—							
Labor	16,354.71	11,798.40	18,717.77	15,617.30	16,479.11	15,775.68	15,160.18
Feed purchased	2,689.12	1,484.51	4,529.27	1,668.07	714.96	739.93	431.10
Materials	5,952.38	1,802.33	7,872.63	9,936.64	9,494.95	9,506.65	9,257.02
Oil, gas and grease	2,727.56	1,732.09	5,251.91	3,421.85	2,071.50	2,757.51	2,440.57
Taxes	2,771.32	2,021.53	2,079.62	1,737.98	1,851.65	1,831.87	1,935.94
Insurance	938.26	739.91	1,083.62	1,220.82	1,467.81	1,420.28	1,340.10
Depreciation	6,192.13	4,127.38	6,759.14	6,399.25	6,732.23	7,209.42	7,183.83
Other	4,648.32	5,611.00	7,173.78	6,665.42	7,274.64	6,085.81	4,832.65
Total	42,273.80	29,317.15	53,467.74	46,667.33	46,086.85	45,327.15	42,581.39
Planting and Cultivating—							
Labor	14,973.74	10,585.67	15,144.06	14,659.11	15,503.46	17,322.07	16,703.72
Seed cane	5,217.71	2,938.51	3,355.43	1,613.16	2,396.36	3,169.58	2,912.45
Fertilizer	3,208.23	2,785.87	5,180.68	3,939.22	4,769.39	5,621.35	5,127.43
Other	654.38	338.85	1,002.27	2,277.59	2,516.64	2,820.01	2,686.83
Total	24,054.06	16,648.90	24,682.44	22,489.08	25,185.85	28,933.01	27,430.43
Harvesting cane—							
Labor	23,352.58	9,436.90	19,006.09	13,472.22	14,723.35	15,867.03	13,826.24
Other	316.40	564.62	1,159.80	1,924.40	2,313.22	2,878.67	3,370.18
Total	23,668.98	10,001.52	20,165.89	15,396.62	17,036.57	18,745.70	17,196.42
Other crops—							
Labor	681.20	1,769.53	2,727.11	1,439.26	1,727.77	1,495.77	962.16
Seed	146.95	423.75	912.39	336.79	384.32	330.93	296.45
Fertilizer	120.97	286.31	359.76	174.61	97.79	121.55	79.38
Other	66.16	481.71	159.35	182.12	333.24	354.17	293.31
Total	2,709.90*	2,961.30	4,158.61	2,132.78	2,543.12	2,302.42	1,825.38‡
Interest	10,576.94	6,826.67	8,865.14	7,770.79	8,005.12	8,394.36	8,308.85
Total cost	103,283.68	65,755.54	111,339.82	94,456.60	98,857.51	103,702.64	97,342.47

(Continued)

APPENDIX TABLE II (Continued)

Items of cost and return	Average per farm						
	3-year average			Annual			
	1937-39	1940-42	1943-45	1946†	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Miscellaneous credits	10,435.46	6,581.98	9,127.78	5,112.84	8,071.33	6,835.30	6,027.06
Net cost	92,848.22	59,173.56	102,212.04	89,343.76	90,786.18	96,867.34	91,315.41
Source of receipts—							
Cane sales	66,604.38	45,673.90	86,672.22	79,710.90	65,861.14	73,745.00	75,778.85
Government payments	21,785.64	11,443.10	32,261.89	14,530.15	12,515.09	13,627.69	13,124.36
Molasses bonus	....	....	....	1,656.57	3,750.32	497.80	....
Total	88,390.02	57,117.00	118,934.11	95,897.62	82,126.55	87,870.49	88,903.21
Miscellaneous receipts—							
Cane for seed	3,362.92	3,199.24	3,300.24	2,254.95	3,541.92	2,764.27	2,633.48
Other crops sold	701.91	1,752.01	2,741.68	560.92	911.24	1,006.13	386.39
Livestock products sold	143.73	221.88	189.34	168.44	232.84	109.29	36.14
Other	2,082.99	1,408.85	2,896.52	2,128.33	3,385.33	2,955.61	2,971.05
Total	10,435.46§	6,581.98	9,127.78	5,112.84	8,071.33	6,835.30	6,027.06
Total receipts	98,825.48	63,698.98	128,061.89	101,010.46	90,197.88	94,705.79	94,930.27
Operating expenses	92,706.74	58,928.87	102,474.68	86,685.81	90,852.39	95,308.28	89,033.62
Net operating income	6,118.74	4,770.11	25,587.21	14,324.65	− 654.51	− 602.49	5,896.65
Net income	−4,458.20	−2,056.56	16,722.07	6,553.86	−8,659.63	−8,996.85	−2,412.20
Capital investment	205,940.66	136,525.99	177,302.95	155,415.85	160,102.41	167,887.22	166,257.18
Cane sold—tons	23,618	12,799	19,033	12,661	9,762	12,782	13,068
Cane grown—acres	1,135	760	961	737	691	712	718

*1937 and 1938 figures not broken down.
†1946 data vary slightly from that published in Mimeograph Circular No. 80, because of the addition of a number of records to expand this sample.
‡"Other crops" for 1949 not broken down.
§Miscellaneous receipts not broken down for 1937.

APPENDIX TABLE III. Costs and Returns Per Ton of Cane Sold on Large Sugar Cane Farms in Louisiana, 3-Year Averages for 1937 Through 1945, Annual Averages for 1946 Through 1949, Inclusive

Items of cost and return	Per ton of cane sold						
	3-year average			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
General overhead—							
Labor	.68	.91	.98	1.23	1.69	1.24	1.16
Feed purchased	.12	.12	.24	.13	.07	.06	.03
Materials	.21	.13	.42	.78	.97	.74	.71
Oil, gas and grease	.13	.15	.27	.27	.21	.21	.19
Taxes	.12	.17	.12	.14	.19	.14	.15
Insurance	.04	.06	.06	.10	.15	.11	.10
Depreciation	.26	.33	.35	.51	.69	.57	.55
Other	.20	.42	.36	.53	.75	.48	.37
Total	1.76	2.29	2.80	3.69	4.72	3.55	3.26
Planting and cultivating—							
Labor	.63	.85	.80	1.16	1.59	1.35	1.28
Seed cane	.22	.23	.18	.13	.24	.25	.22
Fertilizer	.14	.21	.27	.31	.49	.44	.39
Other	.02	.03	.05	.18	.26	.22	.21
Total	1.01	1.32	1.30	1.78	2.58	2.26	2.10
Harvesting cane—							
Labor	.96	.74	.99	1.07	1.51	1.24	1.06
Other	.02	.04	.07	.15	.24	.23	.26
Total	.98	.78	1.06	1.22	1.75	1.47	1.32
Other crops—							
Labor	.05	.15	.14	.11	.18	.12	.07
Seed	.01	.04	.05	.03	.04	.02	.02
Fertilizer	.01	.02	.02	.01	.01	.01	.01
Other	.00	.03	.01	.01	.03	.03	.02
Total	.13*	.24	.22	.16	.26	.18	.13*
Interest	.45	.55	.46	.61	.82	.65	.64
Total costs	4.33	5.18	5.84	7.46	10.13	8.11	7.45
Miscellaneous credits	.45	.51	.48	.40	.83	.53	.46
Net costs	3.88	4.67	5.36	7.06	9.30	7.58	6.99
Source of receipts—							
Cane sold	2.85	3.33	4.56	6.30	6.75	5.77	5.80
Government payments	.92	.90	1.67	1.15	1.28	1.07	1.00
Molasses bonus	....	....	....	.13	.38	.04	....
Total	3.77	4.23	6.23	7.58	8.41	6.88	6.80
Miscellaneous receipts—							
Cane for seed	.16	.25	.17	.18	.36	.21	.20
Other crops sold	.04	.15	.14	.04	.09	.08	.03
Livestock products sold	.00	.02	.01	.01	.03	.01	.00
Other	.09	.09	.16	.17	.35	.23	.23
Total	.45†	.51	.48	.40	.83	.53	.46
Total receipts	4.22	4.74	6.71	7.98	9.24	7.41	7.26
Operating expenses	3.88	4.63	5.38	6.85	9.31	7.46	6.81
Net operating income	.34	.11	1.33	1.13	−.07	−.05	.45
Net income	−.11	−.44	.87	.52	−.89	−.70	−.19
Capital investment	8.82	11.12	9.31	12.28	16.40	13.13	12.72

*1937 and 1938 figures not broken down; 1949 figures not broken down.
†1937 miscellaneous receipts not broken down.

APPENDIX TABLE IV. RELATION BETWEEN ACRES IN CANE PER FARM AND COSTS AND RETURNS ON LARGE SUGAR CANE FARMS IN LOUISIANA, 1946-1949

Acres in cane	Number of farms	Per ton of cane sold				Per Farm		
		Total costs	Total receipts	Net oper. income	Net income	Tons cane sold	Yield per acre in tons*	Acres in cane
	Dollars	Dollars	Dollars	Dollars	Dollars	Tons	Tons	Acres
1946—								
Under 250	13	8.44	8.71	.82	.27	3,178	18.2	177
250-499	23	7.03	7.88	1.38	.85	6,709	18.8	364
500-749	29	6.97	8.01	1.58	1.04	10,533	17.8	606
750-999	18	7.46	8.35	1.46	.89	14,331	17.6	843
1000-over	15	7.82	7.72	.62	− .10	32,112	17.1	1,917
Total	98	7.46	7.98	1.13	.52	12,661	17.7	737
1947—								
Under 250	12	9.60	9.74	.79	.14	2,880	16.9	174
250-499	19	9.94	9.46	.45	− .48	5,408	14.3	380
500-749	15	9.49	9.00	.17	− .49	8,808	14.9	607
750-999	18	9.88	9.11	.04	− .77	12,329	14.7	857
1000-over	12	10.83	9.32	− .61	−1.51	20,880	13.8	1,554
Total	76	10.13	9.24	− .07	− .89	9,762	14.6	691
1948—								
Under 250	12	9.42	7.95	.79	−1.47	3,188	18.6	171
250-499	18	7.50	7.38	.54	− .12	6,945	18.7	370
500-749	18	8.37	7.36	− .39	−1.01	10,586	17.5	602
750-999	14	8.04	7.47	.10	− .57	15,663	18.5	846
1000-over	15	8.10	7.36	− .08	− .74	27,407	17.6	1,560
Total	77	8.11	7.41	− .05	− .70	12,782	18.6	712
1949—								
Under 250	13	8.29	8.02	.36	− .27	3,451	19.5	177
250-499	15	7.85	7.68	.57	− .17	6,736	17.7	380
500-749	18	6.39	5.89	.01	− .50	12,112	20.3	598
750-999	15	7.84	7.77	.57	− .07	15,072	17.5	863
1000-over	14	7.61	7.54	.61	− .07	27,864	17.6	1,581
Total	75	7.45	7.26	.45	− .19	13,068	18.2	718

*Tons cane for seed have been added to tons sold to give yield per acre.

APPENDIX TABLE V. Relation Between the Tons of Cane Sold Per Farm and the Cost of Producing Cane on Large Sugar Cane Farms in Louisiana, 1946 Through 1949, Inclusive

Tons of cane sold	Number of farms	Cost per ton of cane sold					
		Total costs	General overhead	Planting and cultivating	Harvesting	Other crops	Interest
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—							
Under 5,000	17	8.41	3.64	2.49	1.56	.20	.52
5,000-9,999	32	7.17	3.37	1.83	1.25	.17	.55
10,000-14,999	28	7.38	3.73	1.66	1.27	.14	.58
15,000-19,999	11	6.81	3.69	1.41	1.06	.12	.53
20,000-over	10	7.86	3.83	1.91	1.17	.22	.73
Total	98	7.46	3.69	1.78	1.22	.16	.61
1947—							
Under 5,000	19	11.05	4.11	3.33	2.44	.23	.94
5,000-9,999	28	10.90	5.19	2.67	1.80	.46	.78
10,000-14,999	19	10.25	4.79	2.62	1.74	.21	.89
15,000-19,999	5	8.28	4.22	1.68	1.38	.34	.66
20,000-over	5	9.52	4.49	2.58	1.60	.06	.79
Total	76	10.13	4.72	2.58	1.75	.26	.82
1948—							
Under 5,000	15	9.14	3.33	2.81	2.12	.18	.70
5,000-9,999	22	8.30	3.65	2.23	1.44	.34	.64
10,000-14,999	15	7.89	3.49	2.19	1.42	.18	.61
15,000-19,999	14	7.96	3.50	2.11	1.44	.21	.70
20,000-over	11	8.09	3.60	2.34	1.42	.08	.65
Total	77	8.11	3.55	2.26	1.47	.18	.65
1949—							
Under 5,000	16	8.71	3.31	2.60	2.02	.09	.69
5,000-9,999	20	8.33	3.66	2.25	1.42	.29	.71
10,000-14,999	18	8.18	3,67	2.32	1.37	.13	.69
15,000-19,999	9	7.42	3.28	2.00	1.24	.23	.67
20,000-over	12	6.55	2.87	1.88	1.18	.06	.56
Total	75	7.45	3.26	2.10	1.32	.13	.64

APPENDIX TABLE VI. Relation Between the Tons of Cane Sold Per Farm and Income From Producing Cane on Large Sugar Cane Farms in Louisiana, 1946 Through 1949, Inclusive

Tons of cane sold	Number of farms	Income per ton of cane sold						
		Total receipts	Cane sales	Government payments	Molasses bonus	Other receipts	Net oper. income	Net income
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—								
Under 5,000	17	8.63	6.33	1.43	.19	.68	.74	.22
5,000-9,999	32	8.00	6.19	1.23	.14	.44	1.38	.83
10,000-14,999	28	8.16	6.36	1.23	.10	.47	1.36	.78
15,000-19,999	11	8.13	6.28	1.09	.14	.62	1.85	1.32
20,000-over	10	7.66	6.30	1.03	.14	.19	.53	− .20
Total	98	7.98	6.30	1.15	.13	.40	1.13	.52
1947—								
Under 5,000	19	10.10	7.23	1.53	.48	.86	− .01	− .95
5,000-9,999	28	9.38	6.85	1.33	.27	.93	− .74	−1.52
10,000-14,999	19	9.09	6.71	1.27	.38	.73	− .27	−1.16
15,000-19,999	5	9.02	6.98	1.15	.24	.65	+1.40	+ .74
20,000-over	5	9.06	6.35	1.21	.58	.92	+ .33	− .46
Total	76	9.24	6.75	1.28	.38	.83	− .07	− .89
1948—								
Under 5,000	15	7.94	5.78	1.36	.06	.74	− .50	−1.20
5,000-9,999	22	7.40	5.81	1.04	.02	.53	− .26	− .90
10,000-14,999	15	7.40	5.79	1.17	.03	.41	.12	− .49
15,000-19,999	14	7.44	5.81	1.04	.04	.55	.18	− .52
20,000-over	11	7.31	5.71	.99	.05	.56	− .13	− .78
Total	77	7.41	5.77	1.07	.04	.53	− .05	− .70
1949—								
Under 5,000	16	7.99	6.14	1.29	....	.56	− .03	− .72
5,000-9,999	20	7.64	6.07	1.03	....	.54	.02	− .69
10,000-14,999	18	7.72	6.14	1.09	....	.49	.23	− .46
15,000-19,999	9	7.76	6.22	1.04	....	.50	1.01	.34
20,000-over	12	6.58	5.30	.89	....	.39	.59	.03
Total	75	7.26	5.80	1.00	....	.46	.45	− .19

APPENDIX TABLE VII. RELATION BETWEEN THE YIELD OF CANE PER ACRE AND THE COST OF OPERATING LARGE SUGAR CANE FARMS IN LOUISIANA, 1946 THROUGH 1949, INCLUSIVE

Yield per acre—tons	Number of farms	Cost per ton of cane sold					
		Total costs	General overhead	Planting & cultivating	Harvesting	Other crops	Interest
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—							
Under 16.......	24	8.62	4.05	2.21	1.48	.14	.74
16 to 18.9......	35	7.76	3.82	1.84	1.18	.24	.68
19 to 21.9......	28	6.92	3.56	1.59	1.15	.09	.53
22 to 24.9......	7	5.80	3.07	1.20	1.03	.14	.36
25—over.......	4	6.07	2.62	1.61	1.25	.09	.50
Total........	98	7.46	3.69	1.78	1.22	.16	.61
1947—							
Under 16......	46	11.38	5.34	2.88	1.90	.33	.93
16 to 18.9......	19	9.06	4.24	2.34	1.54	.22	.72
19 to 21.9......	10	7.73	3.47	1.97	1.55	.12	.62
22 to 24.9......	1	7.70	3.47	2.15	1.65	....	.43
25—over.......	0	....	....	....	....	....	....
Total........	76	10.13	4.72	2.58	1.75	.26	.82
1948—							
Under 16.......	15	9.33	3.45	2.96	1.75	.28	.89
16 to 18.9......	22	8.36	3.75	2.27	1.47	.19	.68
19 to 21.9......	26	8.02	3.79	2.12	1.37	.18	.56
22 to 24.9......	12	7.10	3.00	2.00	1.41	.09	.60
25—over.......	2	6.27	2.41	1.81	1.34	.09	.62
Total........	77	8.11	3.55	2.26	1.47	.18	.65
1949—							
Under 16.......	23	7.54	3.13	2.22	1.34	.14	.71
16 to 18.9......	22	8.23	3.56	2.40	1.44	.15	.68
19 to 21.9......	21	7.15	3.32	1.88	1.22	.16	.57
22 to 24.9......	9	6.54	2.85	1.80	1.27	.07	.55
25—over.......	0	....	....	....	....	....	....
Total........	75	7.45	3.26	2.10	1.32	.13	.64

APPENDIX TABLE VIII. RELATION BETWEEN YIELD OF CANE PER ACRE AND THE INCOME FROM LARGE SUGAR CANE FARMS IN LOUISIANA, 1946 THROUGH 1949, INCLUSIVE

Yield per acre—tons	Number of farms	Income per ton of cane sold						
		Total receipts	Cane sales	Gov't payments	Molasses bonus	Other receipts	Net oper. income	Net income
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—								
Under 16......	24	8.15	6.16	1.30	.19	.50	.27	– .47
16 to 18.9.....	35	8.03	6.45	1.09	.10	.39	.95	.27
19 to 21.9.....	28	7.89	6.18	1.16	.16	.39	1.50	.97
22 to 24.9.....	7	7.70	6.24	1.00	.07	.39	2.26	1.90
25—over......	4	7.74	6.14	1.24	.12	.24	2.17	1.67
Total.......	98	7.98	6.30	1.15	.13	.40	1.13	.52
1947—								
Under 16......	46	9.34	6.74	1.35	.37	.88	–1.11	–2.04
16 to 18.9.....	19	9.20	6.92	1.20	.41	.67	.86	.14
19 to 21.9.....	10	9.00	6.53	1.20	.38	.89	1.89	1.27
22 to 24.9.....	1	8.68	6.39	1.32	.59	.38	1.41	.98
25—over......	0	....	....	....	....	....	....	....
Total.......	76	9.24	6.75	1.28	.38	.83	– .07	– .89
1948—								
Under 16......	15	7.43	5.60	1.18	.04	.61	–1.01	–1.90
16 to 18.9.....	22	7.44	5.77	1.08	.04	.55	– .24	– .92
19 to 21.9.....	26	7.46	5.86	.98	.03	.59	.00	– .56
22 to 24.9.....	12	7.25	5.75	1.08	.03	.39	+ .75	+ .15
25—over......	2	7.65	5.80	1.35	.12	.38	+2.00	+1.38
Total.......	77	7.41	5.77	1.07	.04	.53	– .05	– .70
1949—								
Under 16......	23	6.48	5.15	.90	....	.43	– .35	–1.06
16 to 18.9.....	22	7.62	6.06	1.07	....	.49	.07	– .61
19 to 21.9.....	21	7.66	6.11	1.02	....	.53	1.08	.51
22 to 24.9.....	9	7.40	6.03	1.06	....	.31	1.41	.86
25—over......	0	....	....	....	....	....	....	....
Total.......	75	7.26	5.80	1.00	....	.46	.45	– .19

APPENDIX TABLE IX. RELATION BETWEEN DIRECT LABOR COSTS PER TON OF CANE SOLD AND COST OF PRODUCING CANE ON LARGE SUGAR CANE FARMS IN LOUISIANA, 1946 THROUGH 1949, INCLUSIVE

Direct labor costs per ton cane sold	Number of farms	Costs per ton of cane sold: Total costs	General overhead	Planting & cultivating	Harvesting	Other crops	Interest
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—							
Less than $2.20...	44	7.05	3.74	1.52	1.03	.19	.57
$2.20 to $2.79....	22	7.48	3.62	1.78	1.31	.16	.61
$2.80—over......	32	8.66	3.60	2.55	1.66	.11	.74
Total......	98	7.46	3.69	1.78	1.22	.16	.61
1947—							
Less than $2.20...	2	7.50	4.12	1.81	.94	.17	.46
$2.20 to $2.79....	15	8.44	4.32	1.98	1.30	.20	.64
$2.80—over......	59	10.98	4.92	2.88	1.98	.29	.91
Total......	76	10.13	4.72	2.58	1.75	.26	.82
1948—							
Less than $2.20...	15	7.36	3.76	1.81	1.18	.11	.50
$2.20 to $2.79....	26	7.70	3.57	2.00	1.36	.18	.59
$2.80—over......	36	8.99	3.41	2.81	1.74	.22	.81
Total......	77	8.11	3.55	2.26	1.47	.18	.65
1949—							
Less than $2.20...	23	6.22	3.02	1.66	.94	.12	.48
$2.20 to $2.79....	22	7.63	3.41	2.04	1.38	.15	.65
$2.80—over......	30	9.25	3.48	2.87	1.86	.17	.87
Total......	75	7.45	3.26	2.10	1.32	.13	.64

APPENDIX TABLE X. RELATION BETWEEN DIRECT LABOR COSTS AND INCOME FROM PRODUCING CANE ON LARGE SUGAR CANE FARMS IN LOUISIANA, 1946 THROUGH 1949, INCLUSIVE

Direct labor costs per ton cane sold	Number of farms	Income per ton of cane sold: Total receipts	Cane sales	Gov't payments	Molasses bonus	Other receipts	Net oper. income	Net income
		Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1946—								
Less than $2.20....	44	7.85	6.33	1.03	.10	.39	1.37	.80
$2.20 to $2.79.....	22	7.97	6.26	1.20	.11	.40	1.10	.49
$2.80—over.......	32	8.37	6.23	1.42	.26	.46	.45	− .29
Total.........	98	7.98	6.30	1.15	.13	.40	1.13	.52
1947—								
Less than $2.20....	2	8.68	7.10	1.04	.13	.41	1.64	1.18
$2.20 to $2.79.....	15	9.09	6.68	1.17	.40	.84	1.29	.65
$2.80—over.......	59	9.33	6.76	1.34	.39	.84	− .74	−1.65
Total.........	76	9.24	6.75	1.28	.38	.83	− .07	− .89
1948—								
Less than $2.20....	15	7.12	5.62	.97	.04	.49	.26	− .24
$2.20 to $2.79.....	26	7.35	5.82	1.03	.03	.47	.24	− .35
$2.80—over.......	36	7.64	5.80	1.16	.05	.63	− .54	−1.35
Total.........	77	7.41	5.77	1.07	.04	.53	− .05	−.70
1949—								
Less than $2.20....	23	6.70	5.40	.87	....	.43	.96	.48
$2.20 to $2.79.....	22	7.67	6.12	1.09	....	.46	.69	.04
$2.80—over.......	30	7.73	6.10	1.13	....	.50	− .65	−1.52
Total.........	75	7.26	5.80	1.00	....	.46	.45	− .19

APPENDIX TABLE XI. GEOGRAPHIC VARIATIONS IN THE COST AND RETURNS FROM THE OPERATIONS OF LARGE SUGAR CANE FARMS IN LOUISIANA, AVERAGE PER TON OF CANE SOLD, FOR THE YEARS 1946 THROUGH 1949, INCLUSIVE

Items of cost and return	1946			1947			1948			1949		
	La-fourche	Teche	Missis-sippi	La-fourche	Teche	Missis-sippi	La-fourche	Teche	Missis-sippi	La-fourche	Teche	Missis-sippi
Number of farms	29	41	28	25	23	28	25	23	29	24	22	29
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
General overhead	3.75	3.63	3.70	4.40	4.45	5.35	3.57	3.48	3.58	2.96	3.20	3.56
Planting and cultivating	1.75	1.80	1.78	2.15	2.82	2.80	1.97	2.47	2.34	1.80	2.49	2.08
Harvesting cane	1.16	1.18	1.34	1.38	1.93	1.95	1.29	1.58	1.53	.96	1.64	1.40
Other crops	.23	.19	.06	.25	.14	.39	.19	.09	.24	.15	.08	.17
Interest	.60	.62	.62	.64	.87	.95	.57	.72	.67	.52	.78	.63
Total costs	7.49	7.42	7.50	8.82	10.21	11.44	7.59	8.34	8.36	6.39	8.19	7.84
Miscellaneous credits	.34	.37	.54	.65	.89	.95	.47	.53	.59	.38	.48	.51
Net costs	7.15	7.05	6.96	8.17	9.32	10.49	7.12	7.81	7.77	6.01	7.71	7.33
Income from cane	6.30	6.40	6.14	6.87	6.51	6.85	5.85	5.68	5.77	5.29	6.08	6.04
Government payments	1.09	1.18	1.18	1.16	1.32	1.38	.99	1.13	1.08	.86	1.14	1.03
Other income	.34	.37	.54	.65	.89	.95	.47	.53	.59	.38	.48	.51
Molasses bonus	.09	.14	.17	.31	.48	.36	.03	.05	.04	....	....	....
Total income	7.82	8.09	8.03	8.99	9.20	9.54	7.34	7.39	7.48	6.53	7.70	7.58
Operating expenses	6.89	6.80	6.88	8.18	9.34	10.49	7.02	7.62	7.69	5.87	7.41	7.21
Net operating income	.93	1.28	1.15	.81	− .14	− .95	.32	−.23	−.21	.66	.29	.37
Net income	.33	.66	.53	.17	−1.01	−1.90	−.25	−.95	−.88	.14	−.49	−.26
Capital investment	11.98	12.38	12.48	12.91	17.54	19.00	11.41	14.55	13.44	10.46	15.61	12.67
Tons cane sold per farm	13,876	12,307	11,919	10,349	10,569	8,576	12,421	12,853	13,029	13,790	12,090	13,212
Averages acres per farm	822	702	699	655	754	670	668	763	708	682	746	726
Yield per acre	17.4	17.8	17.8	16.1	14.3	13.5	18.6	16.9	18.4	20.2	16.2	18.1

,E5D

LOUISIANA BULLETIN NO. 457 JUNE, 1951

Financial Results of the Operation of Raw Sugar Mills in Louisiana 1937 to 1949

LIBRARY
NEW MEXICO STATE UNIVERSITY

By

J. NORMAN EFFERSON AND MILDRED COBB

SURPLUS
Unbindable
Duplicated
NMSU LIBRARY
LAS CRUCES

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. TAGGART, DIRECTOR

TABLE OF CONTENTS

Page

INTRODUCTION 5

PROCEDURE 5

Items of Cost 6

MEASURES OF NET COST AND RETURN 8

OTHER CONSIDERATIONS 8

RESULTS FOR THIRTEEN YEARS 9

Volume of Business 9

Net Returns Per Mill 11

Costs and Returns Per Ton of Cane Ground 13

Costs and Returns per 100 Pounds of Raw Sugar Manufactured 14

Thirteen-Year Average Costs and Returns 16

Factors Affecting Costs and Returns 18

Amount of Cane Ground 19

Sugar Manufactured per Ton of Cane Ground 21

Geographic Variations 21

SUMMARY 23

APPENDIX 26

LIST OF TABLES

Table Page

1. Average volume of cane ground and raw sugar manufactured by Louisiana sugar mills, 1937 to 1949 10
2. Average net returns from the production of raw sugar in Louisiana, 1937 to 1949 11
3. Costs and returns per ton of cane ground by sugar mills in Louisiana, 1937 to 1949 13
4. Costs and returns per 100 pounds of raw sugar manufactured by sugar mills in Louisiana, 1937 to 1949 15
5. Summary table showing 13-year average per mill, per ton cane ground and per 100 pounds sugar manufactured, of costs and returns of Louisiana raw sugar mills, 1937-1949, inclusive 17

APPENDIX TABLES

Table Page

I. Costs and returns per ton of cane ground, Louisiana raw sugar mills; averages, 1937-39, 1940-42, 1943-45; annual, 1946-49 26

II. Costs and returns per mill, Louisiana raw sugar mills; averages 1937-39, 1940-42, 1943-45; annual, 1946-49 27

III. Costs and returns per 100 pounds sugar manufactured, Louisiana raw sugar mills, averages 1937-39, 1940-42, 1943-45; annual 1946-49 29

IV. Relation between the volume of cane ground and the average costs per 100 pounds of raw sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive 30

V. Relation between the volume of cane ground and the income per 100 pounds of sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive 31

VI. Relation between the yield of sugar obtained per ton of cane and the average costs per 100 pounds of sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive 32

VII. Relation between the yield of sugar obtained per ton of cane and the income per 100 pounds of raw sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive 33

VIII. Geographic variations in the financial results obtained from the operation of sugar mills in Louisiana for the years 1946 through 1949, inclusive — for the Teche and Mississippi Regions 34

Financial Results of the Operation of Raw Sugar Mills in Louisiana, 1937 to 1949

By

J. NORMAN EFFERSON AND MILDRED COBB

INTRODUCTION

Detailed studies of the costs and returns from the operation of raw sugar mills in Louisiana were conducted annually by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station from 1937 through 1949.[1] Each year the same general methods of collecting and analyzing the data were employed in order to make the results from year to year directly comparable. In most years, records were collected from 30 to 35 raw sugar mills. During this 13-year period, there were between 40 and 50 sugar mills in the state which manufactured raw sugar primarily; thus the sample studied represented about two-thirds of the raw sugar mills and two-thirds of the raw sugar production in the state.

The purpose of this report is to present a general summary of the financial results of the operation of raw sugar mills in Louisiana for the 13-year period 1937-49, to summarize the detailed annual results for the most recent period, 1946-49, and to make comparisons of significant trends throughout the period covered.

PROCEDURE

Selection of the mills for the sample was determined on a stratified basis according to the relative importance of raw sugar production within the various sections of the Louisiana sugar cane area. Within this broad stratification, the individual selection was based on the degree of cooperation assured by the managers and bookkeepers and the accuracy of the records involved. For the most part, identical mills were studied throughout the 13-year period. The omission of earlier cooperators and their replacement with new ones for some years was made necessary because of changes in the type of sugar produced by some mills. Since the study was limited to an analysis of raw sugar producers, any mill that shifted from the production of raw sugar primarily to a major production of direct consumption sugars was omitted and replaced with a new raw sugar producer from the same region.

---

[1] *Financial Results of the Operation of Sugar Mills in Louisiana, 1937 and 1938* (Louisiana Experiment Station Bulletin No. 316, February, 1940); *Financial Results of the Operation of Sugar Mills in Louisiana, 1939 to 1941* (Louisiana Experiment Station Bulletin No. 373, March, 1944); and *Financial Results of the Operation of Raw Sugar Mills in Louisiana for Nine Years, 1937 to 1945* (Louisiana Experiment Station Bulletin No. 418, June, 1947).

The total costs of operating the mills were divided into five main groups, with each group subdivided into various items. These groupings were determined very largely by the customary practices of the mills in keeping their accounts. Since accounting practices varied somewhat between mills, however, it was necessary to make certain adjustments in the accounts of some of the mills in order to fit them into the arrangement used in this study. In some cases it was necessary to make estimates as to the allocation of costs under the different headings; these estimates were in all cases made by the manager or some other official of the mill. Such allocations affect the distribution of costs between items; they do not affect the total cost of any mill.

Items of Cost

General overhead expenses include those items which could not be accurately allocated to the other divisions. The labor charge under general overhead includes payments for general management and supervision, and clerical and accounting work. Materials include such items as postage, printing, stationery, and office supplies. "Other" expenses include telephone, telegraph, travel, bad debts, contributions, and other miscellaneous overhead items. Taxes (not including state and federal income taxes), insurance, and depreciation have been included as a part of general overhead expenses since the information in the records of most mills was not in such form as to permit a satisfactory division of these items among the other groups of cost. In the cases where one company operated both a raw sugar mill and a sugar cane farm or farms, or where one company operated more than one mill, and maintained a central office for the administration of the multiple-unit enterprises, certain of the general overhead costs, such as clerical labor, office supplies, and similar items, had to be allocated to the mill and to the other enterprises on a percentage basis, usually established on the volume of business of the different enterprises. In all cases these percentage allocations were made by one or more officials of the operating company.

The costs shown under procurement of cane include the purchase of cane from independent growers and the cost of transporting it from the field loading stations to the mills. When cane was obtained from lands operated by the mill, the cost of cane to the mill was considered to be the amount which would have been paid to the independent grower for the same tonnage. Transportation costs for this cane also were included. Most of the mills kept their records in such a way as to show the cost in this manner; in some instances where they did not do so, the records were adjusted to this basis. The transportation charges are composed of amounts paid for railroad freight, truck contract hauling, operation of hoists and derricks, operation of on-farm railroads, and other miscellaneous items connected with the cost of transportation. The transportation costs as shown are somewhat understated because it was not possible to segregate all of the items that should have been included. Depreciation on transportation equipment, such as trucks, on-farm railroads, and similar items, was included in the depreciation items in overhead costs. In a similar manner, no boardinghouse costs were included in transportation charges, although in many cases part or all of the labor employed in transporting cane was fed at the boardinghouse. Also, some part of the labor cost of supervision could be properly charged to transportation, but no basis could be established for determining what part; thus, all supervision costs were charged to overhead. The importance of these items is not very great, but their existence should be recognized.

The costs grouped under manufacture of sugar include those items that were concerned most directly with the actual process of making sugar. Under labor is included all labor not specifically assigned to general overhead or procurement of cane. The cost for fuel includes only fuel purchased and does not include any allowance for bagasse which the mills produced and burned. The costs for lime, sulphur, bags, twine, laboratory and other supplies represent the amount paid for the quantities actually used during the fiscal years. Off-season or dead-season repair costs have been divided between labor and materials. The item "Other" includes such items as lubricants, waste, lights, and other miscellaneous items. In some cases where the cost accounts of a mill were divided into other groupings which did not follow the general scheme used in this study it is possible that certain items were included in "Other" which belonged elsewhere. Such cases were relatively few, however, and would not affect greatly the distribution of costs and would not affect the total costs to any extent.

Selling costs cover the amounts actually paid for commissions and brokerage charges, weighing and gauging, freight and drayage on products sold, storage where space was rented, and allowances made to buyers for any reason. No attempt was made to allocate any part of the general overhead costs to selling, because there was no adequate basis for making such an allocation. It is certainly true, however, that some part of the general overhead costs was incurred in connection with the selling operations.

The interest cost was calculated at 5 per cent of the total value of the assets used in the business. Interest actually paid by the various mills for the use of borrowed funds was not included as a cost, since this would have meant including the same cost twice. This procedure placed all mills on the same basis with respect to capital charges, regardless of the extent of their borrowings or the rate of interest actually paid. The use of the 5 per cent rate in computing interest costs was largely arbitrary. The effect of using a different rate can be determined by applying any desired rate to the capital investment.

MEASURES OF NET COST AND RETURN

The net cost of manufacturing raw sugar was determined by subtracting miscellaneous credits from the total cost. Miscellaneous credits consist of the income received by the mills from any source except the sale of raw sugar. Such income was largely received from the sale of molasses, syrup, and sugar other than raw sugar. In addition, some income was received from the sale of scrap iron and other miscellaneous products. The production of these items was for the most part incidental to the business of manufacturing raw sugar; thus, the income from their sale may be regarded as having reduced the cost of manufacturing raw sugar below what it would have been otherwise.

Total income of the mills includes the receipts from all sales made by the mills, including both raw sugar and the items accounted for in connection with miscellaneous credits. Differences in inventory of products for sale at the beginning and end of each year have been included in calculating income.

Operating expenses include all of the costs except interest on capital. Net operating income is the difference between total income from all sources and operating expenses. It represents the earnings available for the payment of interest, dividends, and additions to surplus. Net income is the amount remaining after subtracting interest at the rate of 5 per cent from the net operating income.

OTHER CONSIDERATIONS

The method used in computing average interest costs is subject to some limitations but is used in an effort to make interest costs comparable for all mills. The only accurate figure available as to the total assets on the books of most of the mills studied was the "depreciated assets" item as used for federal and state income tax purposes. Since many of the older mills have depreciated their assets heavily during the course of time, the capital investment data as used in these studies to compute interest charges are lower than the book value, replacement cost, or sales value of the property. As a result, the interest cost for such mills is much lower than the interest which would have had to be paid if the property were purchased on the open market with the use of borrowed funds.

In interpreting the average operating income before interest and the net income after interest, it should be noted that these two measures of return or profit are the returns *before income taxes,* since no state or federal income taxes are included in the cost items. Income taxes were excluded from the items of cost in order to obtain an average cost per mill and per unit of production which would be directly comparable. This procedure gives more accurate cost data for comparing mill to mill in any one year or averages over a period of years. However, it also overstates the actual profit made by the business and the profit returned to the operators or stockholders.

The amount of cane ground by the mills is reported in net-mill tons, that is, the actual weight of the cane regardless of its sucrose content. The amount of raw sugar manufactured is in terms of 96-degree equivalent rather than the actual weight of the sugar made.

RESULTS FOR THIRTEEN YEARS

A brief summary of the average results for each of the 13 consecutive years studied is shown in Tables 1 through 5. A more detailed analysis of the final results for each year on a per mill, per ton ground, and per hundred pounds of raw sugar produced basis, is presented in Appendix Tables I through III.

Volume of Business

The average volume of business for the mills studied each year from 1937 through 1949, including the tons of cane ground per mill, the pounds of raw sugar manufactured per mill, and the average number of pounds of raw sugar made per ton of cane ground, is shown in Table 1. These results reflect the wide variation that has occurred from year to year in the size of the Louisiana sugar cane crop due to weather conditions, since the acreage has been relatively stable. For the period covered, the average tonnage of cane ground varied from a low point of less than 45,000 tons per mill in 1940 to more than 95,000 tons per mill in 1949. The large volume ground per mill in 1949, however, is due not only to relatively favorable weather conditions and good yields per acre in 1949 but also to another important trend that is occurring in the area. From 1943 through 1947, 7 sugar mills in Louisiana went out of business and the tonnage of sugar cane that normally went to these mills was shifted to other mills, resulting in a larger volume of business in the more recent years of the study. At the end of the 1948 season, an additional 6 mills went out of business. This left a total of 56 operating sugar mills in the state for the 1949 grinding season in comparison with about 70 in the period immediately preceding World War II. The relative size of the sugar cane crop in the 1948-49 period did not increase in proportion to the increase in the volume of business per mill studied because of the gradual reduction in the number of mills in the state.

The pounds of raw sugar manufactured per mill varied from a low point of about 7 million pounds in 1940 to more than 16 million pounds in 1949. This factor is affected by both the volume of cane ground and the average sucrose content of the crop. As a result, even though the tonnage ground per mill averaged about 87 thousand tons in 1943, 1945, and 1948, the production of raw sugar varied from 14 million pounds in 1943 to 13.6 million pounds in 1945 and 13.9 million pounds in 1948.

The average recovery rate, or the amount of raw sugar manufactured per ton of cane ground, varied from 174.5 pounds per ton in 1939 to a low point of less than 150 pounds in 1946.

Table 1. Average volume of cane ground and raw sugar manufactured by Louisiana sugar mills, 1937 to 1949

Year	Number of mills	Average per mill		Average number of pounds of sugar manufactured per ton of cane ground
		Tons of cane ground	Pounds of sugar manufactured	
1937	30	75,561	11,693,449	154.8
1938	32	83,012	14,141,279	170.4
1939	42	74,028	12,917,332	174.5
1940	38	44,447	7,267,582	163.5
1941	36	62,456	10,487,408	167.9
1942	32	76,491	13,052,404	170.6
1943	32	87,117	14,009,962	160.8
1944	29	84,987	12,983,639	152.8
1945	22	87,095	13,556,532	155.7
1946	28	78,620	11,770,117	149.7
1947	25	70,151	10,766,800	153.0
1948	29	87,476	13,885,300	151.0
1949	26	95,988	16,184,100	168.6

From 1939 to 1943, the sugar recovery per ton of cane ground averaged about 170 pounds per ton; from 1943 to 1945, the recovery rate averaged 156 pounds; from 1946 to 1948 the recovery rate declined still further and averaged less than 152 pounds per ton. This long-time declining trend in recovery per ton was at least temporarily arrested in the 1949 season when the mills studied averaged 168.6 pounds of raw sugar per ton of cane ground.

Net Returns Per Mill

The average investment per mill, the net operating income before interest charges, and the net income after interest on a per mill basis for each of the 13 years studied are shown in Table 2. The net operating income has been further converted to the per cent return on investment prior to the payment of interest and taxes.

Total assets, which represent the depreciated value of all buildings, machinery, and equipment used in the operation of

Table 2. Average net returns from the production of raw sugar in Louisiana, 1937 to 1949

Year	Number of mills	Average per mill			
		Total assets	Net operating income	Net income	Per cent return on investment before interest and taxes*
		$	$	$	Per Cent
1937	30	390,253	18,764	— 749	4.81
1938	32	389,398	22,695	3,468	5.83
1939	42	329,857	39,884	23,391	12.09
1940	38	350,993	1,635	— 15,915	0.47
1941	36	400,360	63,973	43,955	15.97
1942	32	401,528	63,730	43,653	15.87
1943	32	446,299	61,444	39,129	13.77
1944	29	452,977	11,212	— 11,437	2.48
1945	22	454,776	50,064	27,325	11.01
1946	28	417,653	68,645	47,762	16.44
1947	25	605,078	16,437	— 13,817	2.71
1948	29	596,623	— 2,915	— 32,743	— 0.49
1949	26	663,842	78,245	45,053	11.79

*Computed by dividing the net operating income by the total assets. Since the net operating income does not include a deduction for actual interest costs or for computed interest costs, this return overstates the actual return by the amount actually paid as interest on borrowed funds and the amount paid in income taxes.

these raw sugar mills, averaged less than $400,000 per mill in the pre-war period but increased to more than $450,000 in the 1943-45 period, to about $600,000 in the 1947-48 period, and averaged $664,000 in 1949. This trend toward an increased investment per mill is due to a general expansion in the volume of business or capacity of the mills and to higher replacement costs during the war and early postwar years for all items of machinery and equipment.

The net operating income, or the excess of receipts over expenses other than interest and income taxes, varied from less than $2,000 per mill in 1940 and a loss of $3,000 per mill in 1948 to peak earnings of near $65,000 per mill in the 1941-43 period and in 1946 and 1949. In 5 years of the 13-year period studied, the net operating income per mill averaged less than $20,000 and in four years, the net operating income averaged more than $60,000 per mill.

In terms of the percentage return on the capital investment prior to interest and income taxes, the net operating income amounted to less than 1 per cent in 2 years, was less than 6 per cent in 6 years of the 13-year period, and was more than 10 per cent in 7 years. The average percentage return on investment before interest and taxes reached a high point in the 1941-43 period but declined drastically in the 1947-48 period to reach the lowest point in the history of this cost study series in 1948, a loss of one-half of one per cent. This serious loss picture for the 1948 season combined with the accumulated losses of the previous year was the major reason why 6 mills, or about 10 per cent of the sugar mills in the state, went out of business after the end of the 1948 grinding season.

The net income, or the excess of receipts over expenses plus a charge of 5 per cent of the average capital investment to cover all interest costs, resulted in a loss of more than $32,000 per mill in 1948, a loss of $16,000 in 1940, and smaller losses in 3 additional years of the 13-year period. Peak earnings in terms of net income were indicated for the three-year period, 1941-43, which averaged about $40,000 annually. In addition, net income per mill averaged about $48,000 in 1946 and $45,000 in 1949.

The earnings of Louisiana raw sugar mills over the 13-year period studied show no important significant trends; in some years returns were relatively good; in others, relatively large losses were incurred. The facts do indicate that returns varied widely from year to year and point out the fallacy of drawing conclusions or making administrative determinations regarding the Louisiana raw sugar industry based on one or two years' returns.

Costs and Returns Per Ton of Cane Ground

A summary of the average costs and returns per ton of cane ground for the mills studied from 1937 to 1945 is presented in Table 3. These data are organized as three-year averages for the 1937-39, 1940-42, and 1943-45 periods and annual results for the 1946-49 period. A more detailed outline of the unit costs and returns per ton is summarized in Appendix Table I.

Unit costs per ton of sugar cane processed averaged about $5.15 per ton in the 1937-39 period, increased to $6.35 per ton in 1940-42, to $7.08 per ton in 1943-45, and varied from $10 to $11 per ton in the 1946-49 period. General overhead and interest costs per ton were relatively stable throughout the 13-year period. Substantial increases occurred, however, in the costs per ton for procurement of cane and in the expenses for the manufacture of raw sugar. Procurement of cane costs advanced from around $3 per ton in the pre-war period to about $7 per ton in the 1946-49 period; manufacture of sugar costs increased from less than $1.00 per ton in the earlier period to almost $2.00 per ton in the most recent years studied.

Table 3. Costs and returns per ton of cane ground by sugar mills in Louisiana, 1937 to 1949

Items of cost and return	Dollars per ton of cane ground							
	3-year averages			Annual				
	1937-1939	1940-1942	1943-1945	1946	1947	1948	1949	4-year ave.
Costs								
General overhead	.51	.68	.56	.77	.95	.79	.77	.82
Procurement of cane	3.24	4.02	4.69	7.04	7.84	6.48	6.84	7.05
Manufacture of sugar	.91	1.16	1.42	1.81	2.09	1.66	1.61	1.79
Selling	.25	.16	.15	.14	.34	.38	.35	.31
Interest	.24	.33	.26	.27	.43	.32	.35	.34
Total	5.15	6.35	7.08	10.03	11.65	9.63	9.92	10.31
Misc. credits	.41	1.22	1.47	1.61	1.93	.77	.60	1.23
Net costs	4.74	5.13	5.61	8.42	9.72	8.86	9.32	9.08
Income								
Raw sugar	4.85	5.44	5.82	9.03	9.53	8.51	9.79	9.21
Miscellaneous	.42	1.22	1.47	1.61	1.93	.77	.60	1.23
Total	5.27	6.66	7.29	10.64	11.46	9.28	10.39	10.44
Operating expenses	4.91	6.02	6.82	9.76	11.22	9.31	9.57	9.97
Net operating income	.36	.64	.47	.88	.24	—.03	.82	.47
Net income	.12	.31	.21	.61	—.19	—.35	.47	.13
Capital investment	4.76	6.51	5.22	5.31	8.63	6.49	6.92	6.84

The cost increases which occurred in the procurement of cane were due to advancing expenses for labor and transportation and to the increased price which was paid for sugar cane under the usual grower-processor purchasing contract. Most of the increased costs for manufacture of sugar were due to higher prices paid for labor in operating during the grinding season and in repairing the mills.

Miscellaneous credits involved in the operations of these sugar mills included income received from the sale of molasses, small amounts of direct-consumption sugar, and all other income except sales of raw sugar. These credits increased from about $0.40 per ton in 1937-39 to more than $1.50 in 1946 and 1947, when molasses prices were unusually high, and then declined to $0.60 per ton in 1949.

The net cost per ton, which is the difference between total costs and miscellaneous credits, increased at about the same rate as total costs. Average net costs per ton of cane processed increased from $4.74 in 1937-39 to $5.13 in 1940-42, $5.61 in 1943-45, and ranged around $9.00 per ton in the 1946-49 period.

Income from raw sugar sales also increased from the prewar level but at a more erratic rate than in the case of costs. Gross receipts from raw sugar varied from $4.85 per ton of sugar cane processed for the 1937-39 period to around $9.00 per ton of cane in the 1946-49 period.

The average net operating income varied from a high point of $0.64 per ton of cane processed for the 1940-42 period and $0.88 per ton in 1946 to a loss of $0.03 per ton ground in 1948. The average net income after interest indicated net losses per ton ranging from $0.01 to $0.35 in 1937, 1940, 1944, 1947, and 1948. An average net gain per ton processed in excess of $0.50 was earned in 1941, 1942, and 1946.

Costs and Returns per 100 Pounds of Raw Sugar Manufactured

A summary of the average costs and returns per 100 pounds of raw sugar manufactured, 96-degree basis, for the mills studied from 1937 through 1949 is presented in Table 4. These data are organized as three-year averages for the 1937-39, 1940-42, and 1943-45 periods and annual results for the 1946-49 period. A more detailed outline of the unit costs per 100 pounds of raw sugar is summarized in Appendix Table III.

Unit costs per 100 pounds of raw sugar produced varied from about $3.11 in the 1937-39 period to $4.53 in the peak wartime period of 1943-45 and then increased still further to average $6.64 per 100 pounds for the 1946-49 period. As in the case of

Table 4. Costs and returns per 100 pounds of raw sugar manufactured by sugar mills in Louisiana, 1937 to 1949

Items of cost and return	Dollars per 100 pounds of raw sugar							
	3-year averages			Annual				
	1937-1939	1940-1942	1943-1945	1946	1947	1948	1949	4-year ave.
Costs								
General overhead	.31	.41	.36	.52	.62	.52	.46	.53
Procurement of cane	1.96	2.40	3.00	4.70	5.11	4.29	4.06	4.54
Manufacture of sugar	.55	.69	.91	1.21	1.37	1.10	.95	1.16
Selling	.15	.10	.09	.09	.21	.25	.21	.19
Interest	.14	.19	.17	.18	.28	.22	.20	.22
Total	3.11	3.79	4.53	6.70	7.59	6.38	5.88	6.64
Miscellaneous credits	.25	.72	.94	1.07	1.26	.51	.35	.80
Net costs	2.86	3.07	3.59	5.63	6.33	5.87	5.53	5.84
Income								
Raw sugar	2.91	3.31	3.72	6.04	6.20	5.63	5.81	5.92
Miscellaneous	.25	.77	.94	1.07	1.26	.51	.35	.80
Total	3.16	4.08	4.66	7.11	7.46	6.14	6.16	6.72
Operating expenses	2.95	3.66	4.36	6.52	7.31	6.16	5.68	6.42
Net operating income	.21	.42	.30	.59	.15	—.02	.48	.30
Net income	.07	.23	.13	.41	—.13	—.24	.28	.08
Capital investment	2.86	3.74	3.34	3.55	5.61	4.30	4.10	4.39

unit costs per ton processed, the costs per unit of raw sugar made for general overhead and interest items fluctuated relatively little during the 13-year period while large advances were noted for costs of procurement of cane and manufacture of sugar.

Net costs per 100 pounds of raw sugar manufactured, computed by deducting miscellaneous credits from total costs, varied from a low of $2.82 for the pre-war period to an average of $5.84 per 100 pounds for the 1946-49 average.

The net operating income per 100 pounds of raw sugar made varied from more than $0.50 in 1941 and 1946 to a net operating loss of $0.02 in 1948. The net income after interest per 100 pounds of raw sugar produced indicated losses in 1937, 1940, 1944, 1947, and 1948; net incomes of less than $0.30 per 100 pounds in 1938, 1939, 1943, 1945, and 1949; and an average net income in excess of $0.40 in 1941 and 1946.

From the pre-war period of 1937-39 to the wartime period of 1943-45, the income from miscellaneous credits, mostly blackstrap molasses, increased from $0.25 per hundred pounds of raw sugar made to $0.94. This advance in income caused by relatively high prices for blackstrap molasses advanced still further in 1946 and 1947 to account for more than $1.00 per unit of raw sugar. After this period, it declined to a postwar low in 1949 of only $0.35 per 100 pounds of raw sugar made. In most years of the study, the net operating income and the net income per unit was less than the income from the by-product, blackstrap molasses. Thus the major reason these mills continued to make net profits, on the average, during the war and early postwar years in spite of increasing costs and controlled prices for raw sugar was because of the increased income from blackstrap molasses. When the price of blackstrap molasses declined in 1948 and to a still lower level in 1949, the average level of earnings decreased drastically, and some mills were forced out of business.

These facts seem to verify the frequently stated opinion of many Louisiana raw sugar processors that in recent years they have produced raw sugar at a loss and have made their profits on their share (the grower is paid a share of the income from molasses under the usual cane purchase contract) of the income from molasses.

This situation points out the major long-time problem of the Louisiana raw sugar industry. Based on the cost and return data for 13 consecutive years, profits in the industry have not been at a high level and have been determined to a great extent by increasing income from molasses since raw sugar prices have been held to stable levels under the Sugar Act controls. If molasses prices revert to levels similar to those existing in the prewar period, the industry will be in serious financial difficulty. This was the case in 1948 and resulted in the largest average loss for the industry of any year of the 13-year period studied. If molasses prices decline or income from molasses is otherwise reduced, the raw mill operators must seek other sources of income or achieve substantial cost reductions. One or more of three actions must follow in this case if the industry is to maintain itself; unit costs must be reduced by increased efficiencies in mill operations; raw sugar prices must be maintained above 1946-49 levels; and/or increased income must be received from other by-products of the industry.

Thirteen-Year Average Costs and Returns

A summary of the average costs, returns, and net profit for the mills studied for the entire 13-year period 1937 through 1949 is shown in Table 5. These data are computed on the basis of a simple average of the annual results for each year of the 13 consecutive years studied.

For the 13-year period, the mills surveyed produced raw sugar at an average cost of $4.71 per hundred pounds. Of this amount, 66.5 per cent was for the purchase of the raw material,

Table 5. Summary table showing 13-year average per mill, per ton cane ground and per 100 pounds sugar manufactured, of costs and returns of Louisiana raw sugar mills, 1937-1949, inclusive

Item	13-year average		
	Average per mill	Average per ton cane ground	Average per 100 lbs. sugar made
	$	$	$
Costs			
General overhead	50,772.59	.66	.41
Procurement of cane	391,592.52	5.05	3.13
Manufacture of sugar	106,772.93	1.38	.85
Selling	17,740.99	.23	.14
Interest	22,672.00	.29	.18
Total	589,551.03	7.61	4.71
Miscellaneous credits	85,231.93	1.10	.68
Net cost	504,319.10	6.51	4.03
Income			
Raw sugar	519,632.68	6.71	4.15
Miscellaneous	85,231.94	1.10	.68
Total	604,864.62	7.81	4.83
Operating expenses	566,879.03	7.32	4.53
Net operating income	37,985.59	.49	.30
Net income	15,313.59	.20	.12
Capital investment	453,818.14	5.85	3.63
Tons cane ground	77,495		.61
Pounds sugar made	12,516,608	161.5	
Average number of mills	31		

sugar cane, and 33.5 per cent was for operating costs. The income from miscellaneous sources, mostly blackstrap molasses, averaged $0.68 per hundred pounds of raw sugar produced, resulting in a net cost (total costs minus miscellaneous credits) of $4.03 per hundred pounds. These processors received an average price of $4.15 per hundred pounds for all raw sugar produced. The resulting net income amounted to an average of about $15,000 per mill per year, $0.20 per ton of cane ground, or $0.12 per hundred pounds of raw sugar manufactured. The net income per mill averaged 3.4 per cent annually on an average capital investment, as depreciated for income tax purposes, of $454,000 per mill. Replacement values at the 1949-50 level would be from three to four times the depreciated book value of all assets. On this basis, the net income was about 1 per cent annually of the replacement value of assets used in the business. In view of the risky nature of the raw sugar processing business and the widely fluctuating returns from year to year, these average returns cannot be considered high and are relatively low in comparison to returns from many other types of manufacturing businesses for the same period.

In terms of the costs and returns for the manufacture of raw sugar in Louisiana, the 13-year period 1937-49 can be characterized as a period of 4 favorable years, 4 average years, and 5 very unfavorable years. The 4 favorable years were 1941, 1942, 1943, and 1946, in which costs in relation to prices were favorable and weather conditions permitted seasonal operations resulting in fairly good yields of sugar per ton of cane ground. The 4 average years were 1938, 1939, 1945, and 1949. The 5 unfavorable years were 1937, 1940, 1944, 1947, and 1948. Each of these seasons was characterized by relatively small crops and low recovery rates per ton ground.

A summary of the detailed average costs and returns for each of the three-year periods, 1937-39, 1940-42, and 1943-45, and annual results for the 1946-49 period is presented in Appendix Tables I, II, and III. The average net income per hundred pounds of raw sugar manufactured amounted to $0.07 in the 1937-39 period, $0.18 in 1940-42, $0.13 in 1943-45, and varied for the most recent period from a loss of $0.24 in 1948 to a gain of $0.28 in 1949.

Factors Affecting Costs and Returns

The unit costs and returns in the operation of raw sugar mills in Louisiana are affected by a great number of diverse factors, some under the control of the management and many beyond control of the individual operators. The major factors determining the unit costs, returns and net profits from the manufacture of raw sugar, as indicated by the Louisiana raw sugar mill studies from 1937 to 1949, appear to be the annual variations in the size of the crop, which is determined more by the weather than by the acreage planted, since the acreage is relatively stable from year to year; the kind of prevailing weather during the grinding season and the presence or absence of damaging frosts; the yield of sugar per ton of cane ground, which is determined in the short run by the weather and other factors, such as the amount of trash, etc.; and the price received for raw sugar and blackstrap molasses. The favorable or unfavorable effect of the first three of these four factors is dependent, in any one year, on the weather. In comparison to most other manufacturing industries, sugar mill operations must be considered relatively risky and speculative enterprises because of this great dependence on uncontrollable and unforseen climatic conditions for profits or losses in any one year.

The last of these four major factors, the price of sugar and molasses, is also beyond the control of the individual operator.

Sugar and molasses prices are established at national and international levels. Also because sugar supplies produced in Louisiana make up only about 7 per cent of normal consumption requirements in the United States, the Louisiana sugar production has little effect on sugar supplies for the nation as a whole; therefore, producers and processors in this state do not have the advantage held by some agricultural areas of a short crop usually being accompanied by a compensating high price. For this region, historical price trends indicate that a short crop is just as likely to be accompanied by a relatively low price as by a high price.

The financial results of the raw sugar mill studies in Louisiana from 1937 to 1949 show, however, that in any given year and under the same climatic conditions and the same price structure, there are still variations from mill to mill in costs, returns, and net profits. It follows then that there are reasons for variations in returns other than the major ones listed heretofore. These factors causing one mill to have lower costs and higher returns than another in the same area in the same year are both physical and economic in character. Since this series of studies has been limited to a statistical analysis of the final results for each year, no attempt has been made to study the physical and internal-management problems of the raw sugar mills, although it is recognized that differences do exist and that these variations cause much of the final differences in costs, returns, and net incomes. The financial factors that were found to be most important in affecting costs, returns, and profits from the annual statistical analysis of the Louisiana mills were the amount of cane ground and the sugar manufactured per ton of cane ground.

Amount of Cane Ground

Over the past 25 years, the number of sugar mills in Louisiana has been decreasing gradually and the average size or capacity of the mills has been increasing. An analysis of the financial results obtained by large- and by small-capacity mills in Louisiana from 1937 to 1949 indicates that perhaps the trend toward larger mills should continue, although it is recognized that many factors other than those concerning information which has been obtained in these studies will have an important influence on future trends.

The number of tons of cane ground by a sugar mill in any season is of course closely related to the size of the mill. This relationship is by no means perfect, since some mills operate nearly maximum capacity or for a greater number of days than others, but an analysis of the rated capacity of the mills in relation to costs and returns gives practically the same results as an analysis of variations in the actual volume ground for the season.

The relationship of the volume of cane processed per mill during the usual 90-day season in Louisiana for the mills studied in the most recent period, 1946-49, is shown in Appendix Tables IV and V.

During the period of time covered by these studies, the general trend has been for the total cost per hundred pounds of sugar manufactured to decline as the volume of cane processed increased and for the total income per hundred pounds to increase with increased mill capacity. In each of the 13 years studied, the mills with the largest annual tonnage processed had lower costs and higher net returns than those with smaller volumes of business. In the most recent year studied, 1949, the mills grinding less than 50,000 tons of cane per mill for the season had average costs of $6.50 per hundred pounds of sugar made and had an average net loss of $0.49 per hundred pounds of raw sugar. The group of mills grinding 75,000 tons or more per mill for the season had average costs of only $5.88 per hundred pounds of raw sugar and made an average net income of $0.35 per hundred pounds of raw sugar made. Similar relationships are indicated for most of the other years studied.

The low-volume mills made average net losses in 9 of the 13 years studied, those of medium volume had net losses in 5 years, and the mills with above-average volumes of cane ground had average net losses in only 2 of the 13 years studied.

Most of the reduction in unit costs with increased tonnages ground occurred in the costs of manufacturing and in selling costs. This indicates that the increased volume of business generally was associated with greater efficiency in the actual process of converting cane into sugar and in selling the increased amount produced, but had little consistent relationship to most of the other costs.

In addition to the financial relationship of volume to costs, a very significant physical fact is indicated in the analysis. In all of the years studied, the recovery factor, or the number of pounds of sugar manufactured per ton of cane ground, was greater for the large-volume mills than for those of lesser volume. Also, in most years, the small-volume mills recovered in the form of raw sugar a smaller percentage of the sucrose in the cane ground than did the large-volume mills. This indicates that part of the decreased costs and increased net income obtained by the large-volume mills was due to the greater technical efficiency of the larger mills.

Sugar Manufactured per Ton of Cane Ground

One of the most important factors causing differences in the unit costs, returns, and net profits from raw sugar mill operations is the number of pounds of sugar manufactured per ton of cane ground. Variations in the yield of sugar per ton of cane are caused by two major factors. One is the percentage of sucrose in the cane, and the other is the technical efficiency of the mill. Differences in the sucrose content of the cane are compensated, at least partly, by corresponding differences in the price paid for cane by the mill under the usual cane-purchase contract. Differences in the technical efficiency with which the sucrose content of the cane is converted into raw sugar are not compensated by price differentials and remain the major variable to affect the financial results achieved by the mill. It is recognized also that other factors, such as the amount of trash and immature tops, are important in determining final yields, but a study of these factors was beyond the scope of this investigation.

The relationship of the amount of raw sugar manufactured per ton of cane ground for the mills studied in the 1946-49 period is shown in Appendix Tables VI and VII. In all of the years studied, there was a general tendency for the mills with relatively high recovery per ton of cane ground to produce sugar at a lower cost per pound than for the mills with relatively low recovery rates.

For the most recent year in which complete results are available, 1949, the mills recovering less than 150 pounds of raw sugar per ton had average costs of $7.99 per hundred pounds of raw sugar; the group recovering from 150 to 159.9 pounds per ton produced raw sugar at a cost of $6.27 per hundred; the group recovering from 160 to 169.9 had average costs of $5.83; those recovering from 170 to 179.9 had costs averaging $5.80 per unit; while the 3 mills averaging more than 180 pounds per ton produced raw sugar at a cost of only $5.80 per hundred pounds. Similar relationships existed in all the other years studied, with average costs per unit for the group with the lowest recovery rates being 10 to 30 per cent higher than for the group with highest rates of sugar produced per ton of cane ground.

The more important factors causing variation in the yield of sugar per ton of cane and in the resulting differences in costs and net returns were the size or capacity of the mills and the higher extraction rates obtained by some mills in each size group.

Geographic Variations

There appear to be some differences in operating conditions in different parts of the Louisiana area where sugar mills are located. In order to study the significance of some of these differences, the mills surveyed each year have been divided into two groups according to their geographic location. One group, referred to as mills in the Teche region, includes all mills west of the Atchafalaya River. Most of these mills are located on or close to Bayou Teche. The other group, referred to as mills in the Mississippi region, includes all of the mills studied that were situated east of the Atchafalaya River. Most of these mills are located near the Mississippi River or along Bayou Lafourche. It is recognized that there are many variations of geographic significance within each of these major regions; the number of mills included in this series of studies, however, was not large enough to warrant further division of the mills by smaller regions.

Average costs, returns, and net incomes per hundred pounds of raw sugar manufactured for the mills located in each of the two major regions from 1946 to 1949 are shown in Appendix Table VIII.

In terms of the net returns per unit, the Teche region had a slight advantage over the Mississippi area for the entire 13-year period studied. The major difference in average unit costs between the mills studied in the two regions was the variation in the direct costs for the manufacture of sugar. Costs for general overhead, procurement of cane, selling, and interest averaged about the same for each area, while direct manufacturing costs per hundred pounds of raw sugar averaged somewhat less in the Teche region than in the Mississippi area for the entire 13-year period.

The factors indicated to be at least partly responsible for this long-time average relationship were the larger amount of sugar obtained per ton of cane ground and the larger volume of business of the Teche mills as compared with those in the Mississippi region.

In the most recent four-year period, however, this trend has changed. From 1946 through 1949, the average net income per unit of raw sugar produced was higher, or the losses less, for the Mississippi region in three of the four years. Part of this variation was due to the well-recognized principle of diminishing returns to larger-volume mills in periods of unfavorable conditions; in such periods, the larger the business, the greater are the losses. Some of the variation may have been due to a gradual increase in the size of the Mississippi mills; in recent years, more mills in the Mississippi region have discontinued operations than was the case in the Teche area.

The variation in the yield of sugar per ton of cane ground was one of the most significant differences between the two regions. In 12 of the 13 years studied, the rate of recovery obtained by the mills in the Teche region was larger than that obtained in the Mississippi area. In the earlier years of the period, the difference varied between 7 to 10 pounds of raw sugar per ton of cane. In the 1947-49 period, however, the average difference was less than 5 pounds. Part of this change can be attributed to the use of mechanical harvesters. The Teche region, being an area with a larger proportion of small family-type sugar cane farms, was slower to adopt the harvesting machine. As a result, the differences in yields of raw sugar per ton of sugar cane in the 1940-46 period was partly an indication of the processing of machine-harvested cane in the Mississippi region in comparison with hand-harvested cane in the Teche area. As machine harvesting became more prevalent in all areas, this average difference was reduced.

The facts indicate that variations do exist within the Louisiana sugar cane area as to yields of sugar per ton of cane ground, and as to costs and returns from the manufacture of raw sugar. These differences, however, are slight and show no trend or central tendency to indicate that one area is far superior to another over a long period of time.

SUMMARY

1. Detailed studies of the costs and returns from the operation of raw sugar mills in Louisiana have been conducted by the Department of Agricultural Economics of the Louisiana Agricultural Experiment Station each year since 1937. This report summarizes the detailed results of these studies for the 1946-49 period with comparisons for the entire 13-year period.

2. Records were collected from approximately 30 mills each year. The sample was restricted to mills which produced primarily raw sugar. For the entire 13-year period, the sample studied represented about two-thirds of the total raw sugar production in the state.

3. All statistical and financial data collected were obtained from the audited statements of the cooperating companies and individuals. Because of variations in bookkeeping practices, it was necessary to make some adjustments in the records of certain mills in order to keep all records on a comparable basis. These allocations affected the distribution of costs and returns between items to a minor extent but did not affect the total cost of any mill.

4. For the period covered, the average tonnage of cane ground varied from a low point of less than 45,000 tons per mill in 1940 to more than 95,000 tons in 1949. The volume per mill has gradually increased during the 13-year period. Although the

production of sugar cane for the state as a whole has remained relatively constant, the number of mills has declined. From 1943 through 1948, 13 raw sugar mills, or about 20 per cent of all mills in the state, went out of business. This factor also affected the production of raw sugar; the pounds of raw sugar manufactured per mill varied from a low point of about 7 million pounds in 1940 to more than 16 million pounds in 1949.

5. The average recovery rate, or the amount of raw sugar manufactured per ton of cane ground, varied from more than 174 pounds in 1939 to a low point of less than 150 pounds in 1946. From 1939 to 1942, raw sugar recovery averaged 170 pounds; from 1943 to 1945, the rate was 156 pounds; from 1946 to 1948, it declined still further and averaged 152 pounds per ton. This long-time declining trend in recovery rates was at least temporarily arrested in the 1949 season when the mills studied averaged 168.6 pounds of raw sugar per ton.

6. The average net income from raw sugar operations, or the excess of receipts over expenses plus interest charges, resulted in a loss of more than $32,000 per mill in 1948, a loss of $16,000 in 1940, and smaller losses in 3 additional years of the 13-year period. Peak earnings were indicated for the 1941-43 period, in which net income averaged about $40,000 per mill annually. In the 1946-49 period, net income averaged more than $40,000 per mill in 1946 and 1949 but substantial net losses occurred in 1947 and 1948.

7. Unit costs averaged $5.15 per ton of cane ground in the 1937-39 period, increased to $6.35 per ton in 1940-42, to $7.08 per ton in 1943-45, and varied from $10 to $11 per ton in the 1946-49 period. Expense items increasing most rapidly during the 13-year period were direct labor costs and expenses involved in the procurement of cane.

8. Income from raw sugar sales and by-products also increased from the pre-war level but at a more erratic rate than in the case of costs. Gross receipts from raw sugar averaged $4.85 per ton of sugar cane processed for the 1937-39 period to around $9.00 per ton of cane in the 1946-49 period.

9. In most years of the study, the net operating income and net income per unit was less than the income from the by-product, blackstrap molasses. When the price of molasses declined in 1948, the average level of earnings declined drastically, and some mills were forced out of business. The facts seem to verify the frequently stated opinion of many Louisiana raw sugar processors that in recent years they have produced raw sugar at a loss and have made their profits on their share of the income from molasses.

10. It appears from the 13-year study of cost and return data that if molasses prices decline or income from molasses is further reduced in future years, then the raw mill operators must seek other sources of income or achieve substantial cost reductions if they are to remain in business. One or more of three developments must follow in this case; unit costs must be reduced by efficiencies in mill operations; raw sugar prices must be maintained above 1946-49 levels; and/or increased income must be received from other by-products of the industry.

11. For the entire 13-year period, the mills surveyed produced raw sugar at an average cost of $4.71 per hundred pounds. Of this amount, 66.5 per cent was for the purchase of sugar cane and 33.5 per cent was for operating costs. These processors received an average gross income of $4.83 per hundred pounds of raw sugar. The resulting net income amounted to an average of about $15,000 per mill per year, $0.20 per ton of cane ground, or $0.12 per hundred pounds of raw sugar processed. The net income per mill averaged 3.4 per cent annually on the average capital investment. In view of the risky nature of the business, these average returns cannot be considered high.

12. In most of the years studied, the mills with the largest annual tonnage ground had lower costs and higher net returns than those with the smallest tonnage for the year. The principal advantage of the large-capacity mills in obtaining lower costs per unit appeared to be in reduced unit costs of manufacture and marketing. Also, the amount of sugar manufactured per ton of cane and the percentage of available sucrose recovered as raw sugar were greater for the large-capacity than for the small-capacity mills.

13. In all the years studied, there was a general tendency for the mills with relatively high average recovery per ton of cane ground to produce raw sugar at a lower cost per pound than the mills with relatively low yields of sugar made per ton processed. The most important factors causing variations in the yield of sugar per ton of cane ground and in resulting net incomes were the size of the mills and the rate of extraction.

14. There appeared to be some differences in operating conditions and costs in the various geographic areas making up the Louisiana sugar cane area. Variations occurred as to yield of sugar per ton of cane ground and in costs and returns between the two major regions, the Mississippi area and the Teche region. These differences were slight, however, and showed no trend to indicate that one area was far superior to another over a long period of time.

Appendix Table 1. Costs and returns per ton of cane ground, Louisiana raw sugar mills; averages, 1937-39, 1940-42, 1943-45; annual, 1946-49

Items of cost and return	Per ton of cane ground						
	3-year averages			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
General overhead	$	$	$	$	$	$	$
Labor	.14	.18	.15	.23	.24	.21	.19
Materials	.03	.01	.01	.02	.05	.03	.04
Taxes	.06	.08	.07	.07	.09	.08	.09
Insurance	.07	.10	.07	.09	.12	.09	.09
Depreciation	.17	.26	.21	.25	.36	.31	.32
Other	.04	.05	.05	.11	.09	.07	.04
Total	.51	.68	.56	.77	.95	.79	.77
Procurement of cane							
Labor	.04	.08	.06	.09	.14	.11	.09
Transportation	.31	.30	.41	.47	.58	.55	.59
Cane purchased	2.82	3.54	4.18	6.42	6.74	5.78	6.16
Other	.07	.10	.04	.06	.38	.04	.00
Total	3.24	4.02	4.69	7.04	7.84	6.48	6.84
Manufacture of sugar							
Labor	.37	.51	.64	.68	.80	.70	.63
Fuel	.12	.12	.13	.16	.23	.20	.14
Lime, sulphur, etc.	.02	.07	.07	.02	.08	.07	.07
Bags and twine	.06	.08	.11	.11	.17	.17	.19
Laboratory supplies	.01	.01	.00	.01	*	*	*
Other supplies	.03	.06	.08	.10	.05	.05	.06
Repairs — labor	.10	.10	.13	.27	.33	.19	.21
Repairs — material	.16	.14	.20	.38	.41	.26	.29
Other	.04	.07	.06	.08	.02	.02	.02
Total	.91	1.16	1.42	1.81	2.09	1.66	1.61
Selling							
Commission	.06	.04	.04	.03	.04	.05	.05
Weighing & gauging	.01	.01	.01	.01	.01	.00	.01
Storage	.01	.01	.01	.01	.01	.00	.01
Freight & drayage	.16	.09	.09	.07	.24	.28	.27
Other	.01	.01	.00	.01	.02	.01	.01
Total	.25	.16	.15	.14†	.34†	.38†	.35
Interest	.24	.33	.26	.27	.43	.32	.35
Total costs	5.15	6.35	7.08	10.03	11.65	9.63	9.92
Misc. credits	.41	1.22	1.47	1.61	1.93	.77	.60
Net costs	4.74	5.13	5.61	8.42	9.72	8.86	9.32
Receipts							
Raw sugar	4.85	5.44	5.82	9.03	9.53	8.51	9.79
Misc. receipts							
Other sugars	.06	.18	.03	.01	—	—	.02
Syrup	.03	.08	.00	.17	—	—	.11
Molasses	.26	.86	1.28	1.29	1.79	.65	.39
Other	.07	.10	.16	.14	.14	.12	.08
Total	.42	1.22	1.47	1.61	1.93	.77	.60
Total receipts	5.27	6.66	7.29	10.64	11.46	9.28	10.39
Operating expenses	4.91	6.02	6.82	9.76	11.22	9.31	9.57
Net operating income	.36	.64	.47	.88	.24	—.03	.82
Net income	.12	.31	.21	.61	—.19	—.35	.47
Capital investment	4.76	6.51	5.22	5.31	8.63	6.49	6.92
Sugar made, pounds	166.53	167.34	156.44	149.70	153.00	151.00	168.60

*Less than $.005.

†Totals will not add up as all figures were not broken down.

Appendix Table II. Costs and returns per mill, Louisiana raw sugar mills; averages 1937-39, 1940-42, 1943-45; annual, 1946-49

Items of cost and return	Average per mill						
	3-year averages			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	$	$	$	$	$	$	$
General overhead							
Labor	10,683.93	10,756.58	13,053.69	18,313.21	17,534.27	19,321.42	18,771.52
Materials	1,361.26	613.45	907.28	1,608.22	2,901.07	2,440.83	3,696.13
Taxes	4,963.51	4,618.05	5,960.77	5,704.81	6,818.77	7,883.72	8,365.36
Insurance	5,453.67	5,823.08	6,307.79	6,822.09	7,920.82	8,243.97	9,224.33
Depreciation	13,306.81	15,221.91	18,107.79	19,459.59	25,796.20	28,265.35	30,536.67
Other	3,287.74	3,476.95	4,636.52	8,763.99	5,910.09	6,636.41	3,482.55
Total	39,056.92	40,510.02	48,973.84	60,671.91	66,881.22	72,791.70	74,076.56
Procurement of cane							
Labor	3,578.47	5,444.29	5,341.69	7,389.44	9,924.38	9,742.16	8,582.20
Transportation	23,768.29	18,443.71	35,530.32	36,962.81	40,682.56	50,834.86	57,172.90
Cane purchased	218,566.84	224,740.83	360,974.90	504,527.44	472,814.72	531,755.44	590,916.27
Other	5,232.93	6,701.52	3,214.13	4,721.34	26,614.73	3,339.36	108.29
Total	251,146.53	255,330.35	405,061.04	553,601.03	550,036.39	595,671.82	656,779.68
Manufacture of sugar							
Labor	28,986.39	31,093.06	55,513.69	53,563.91	56,288.58	64,839.89	60,534.75
Fuel	8,639.08	5,969.55	10,167.64	12,824.67	16,386.92	18,321.40	13,463.53
Lime, sulphur, etc.	1,454.20	943.33	993.34	1,801.68	—	—	—
Bags and twine	5,028.75	5,254.72	9,107.61	8,296.78	11,943.40	15,549.91	18,651.87
Laboratory supplies	709.61	322.28	305.65	764.16	5,795.88	6,714.58	6,305.90
Other supplies	2,816.95	3,051.68	5,611.76	7,840.55	345.20	4,543.63	5,257.00
Repairs - labor	7,837.47	8,406.15	14,875.53	21,131.16	22,638.08	17,537.93	20,542.09
Repairs - material	12,457.12	10,951.16	21,043.25	29,924.09	29,094.70	24,169.71	27,921.47
Other	2,744.87	4,358.12	4,975.53	6,448.49	1,534.68	1,490.82	1,585.33
Total	70,674.44	70,350.05	122,594.00	142,595.49	147,167.44	153,167.89	154,261.94

(Continued next page)

Appendix Table II. (Continued)

Items of cost and return	Average per mill						
	3-year averages			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
Selling							
Commission	4,701.73	2,659.06	3,494.42	2,582.26	2,982.69	4.316.59	4,658.53
Weighing & gauging	880.98	392.59	588.98	469.67	558.57	652.36	787.85
Storage	407.92	364.07	464.13	799.32	870.52	362.95	832.18
Freight & drayage	12,282.80	5,567.90	7,894.58	5,481.34	16,842.45	26,095.41	26,298.37
Other	1,232.87	712.06	726.25	743.96	1,549.21	146.98	1,343.33
Total	19,506.30	9,695.68	13,168.36	11,234.63	23,565.46	34,701.51*	34,020.26
Interest	18,410.87	19,214.68	22,567.53	20,882.73	30,253.90	29,828.03	33,192.08
Total cost	398,795.06	395,100.78	612,364.77	788,985.79	817,804.41	886,160.93	952,330.52
Misc. credits	31,998.23	79,347.70	127,725.00	126,616.81	135,664.54	70,933.43	57,587.58
Net cost	366,796.83	315,753.08	484,639.77	662,368.98	894,742.94	815,227.50	894,742.94
Receipts							
Raw sugar	375,500.23	339,651.06	502,978.72	710,131.46	668,422.86	782,484.37	939,796.20
Misc. receipts							
Other sugars	4,198.70	11,212.54	3,057.39	845.47	—	—	2,264.07
Syrup	2,204.55	4,699.01	378.11	13,046.82	—	—	10,404.13
Molasses	19,952.99	57,012.39	110,476.84	101,897.52	125,588.60	60,189.30	37,092.20
Other	5,641.99	6,423.76	13,812.66	10,797.01	10,075.94	10,744.13	7,827.18
Total misc.	31,998.23	79,347.70	127,725.00	126,616.82	135,664.54	70,933.43	57,587.58
Total receipts	407,498.46	418,998.76	630,703.72	836,748.28	804,087.40	853,417.80	997,383.78
Operating expense	380,384.19	375,886.10	589,797.24	768,103.06	787,650.51	856,332.90	919,138.44
Net operating income	27,114.27	43,112.66	40,906.48	68,645.22	16,436.89	- 2,915.10	78,245.34
Net income	8,703.40	23,897.98	18,338.95	47,762.49	-13,817.01	-32,743.13	45,053.26
Capital investment	369,835.98	384,297.07	451,350.38	417,652.67	605,078.18	596,622.68	663,842.12
Sugar made - pounds	12,917,353	10,269,131	13,516,711	11,770,117	10,766,800	13,885,300	16,184,100
Cane ground	77,533	61,131	86,399	78,620	70,151	91,949	95,988

*Total will not check out as some figures were not broken down.

Appendix Table III. Costs and returns per 100 pounds sugar manufactured, Louisiana raw sugar mills, averages 1937-39, 1940-42, 1943-45; annual 1946-49

Items of cost and return	Per 100 pounds of sugar						
	3-year averages			Annual			
	1937-39	1940-42	1943-45	1946	1947	1948	1949
	$	$	$	$	$	$	$
General overhead							
Labor	.08	.11	.09	.16	.16	.14	.12
Materials	.01	.01	.01	.01	.03	.02	.02
Taxes	.04	.05	.05	.05	.06	.05	.05
Insurance	.05	.06	.05	.06	.07	.06	.06
Depreciation	.10	.15	.13	.17	.24	.20	.19
Other	.03	.03	.03	.07	.06	.05	.02
Total	.31	.41	.36	.52	.62	.52	.46
Procurement of cane							
Labor	.03	.05	.04	.06	.09	.07	.05
Transportation	.18	.18	.27	.31	.38	.37	.35
Cane purchased	1.71	2.11	2.67	4.29	4.39	3.83	3.65
Other	.04	.06	.02	.04	.25	.02	.01
Total	1.96	2.40	3.00	4.70	5.11	4.29	4.06
Manufacture of sugar							
Labor	.23	.31	.41	.46	.52	.47	.37
Fuel	.07	.07	.08	.11	.15	.13	.08
Lime, sulphur, etc.	.01	.04	.04	.02	—	—	—
Bags and twine	.04	.04	.07	.07	.11	.11	.12
Laboratory supplies	.00	.01	.01	.01	.06	.05	.04
Other supplies	.02	.03	.05	.06	.03	.03	.03
Repairs — labor	.06	.06	.08	.18	.21	.13	.13
Repairs — material	.10	.09	.13	.25	.27	.17	.17
Other	.02	.04	.04	.05	.02	.01	.01
Total	.55	.69	.91	1.21	1.37	1.10	.95
Selling							
Commission	.03	.03	.02	.02	.02	.03	.03
Weighing and gauging	.01	*	*	.00	.01	.00	.00
Storage	.00	.00	.00	.01	.01	.00	.01
Freight & drayage	.10	.06	.06	.05	.15	.19	.16
Other	.01	.01	.01	.01	.02	.01	.01
Total	.15	.10	.09	.09	.21	.25*	.21
Interest	.14	.19	.17	.18	.28	.22	.20
Total costs	3.11	3.79	4.53	6.70	7.59	6.38	5.88
Misc. credits	.25	.72	.94	1.07	1.26	.51	.35
Net costs	2.86	3.07	3.59	5.63	6.33	5.87	5.53
Receipts							
Raw sugar	2.93	3.25	3.72	6.04	6.20	5.63	5.81
Misc. receipts							
Other sugars	.04	.10	.02	.01	.	.	.01
Syrup	.01	.05	.00	.11	.	.	.06
Molasses	.16	.51	.82	.86	1.16	.43	.23
Other	.04	.06	.10	.09	.10	.08	.05
Total	.25	.72	.94	1.07	1.26	.51	.35
Total receipts	3.18	3.97	4.66	7.11	7.46	6.14	6.16
Operating expenses	2.97	3.60	4.36	6.52	7.31	6.16	5.68
Net operating income	.21	.37	.30	.59	.15	—.02	.48
Net income	.07	.18	.13	.41	—.13	—.24	.28
Capital investment	2.88	3.91	3.34	3.55	5.61	4.30	4.10
Cane ground — tons	.61	.60	.64	.67	.65	.66	.59

*Selling total will not check out as some figures were not broken down.

Appendix Table IV. Relation between the volume of cane ground and the average costs per 100 pounds of raw sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive

Tons of cane ground	Average tons ground	Number of mills	Costs per 100 pounds of sugar					
			Total costs	General Overhead	Procurement of cane	Mfg. of sugar	Selling	Interest
Under 50,000 tons			$	$	$	$	$	$
1946	44,844	7	6.64	.53	4.62	1.19	.08	.22
1947	41,037	8	7.82	.71	5.08	1.49	.27	.27
1948	34,597	3	6.27	.58	4.16	1.02	.27	.24
1949	43,352	2	6.50	.48	4.31	1.20	.15	.36
50,000-74,999 tons								
1946	61,668	8	6.54	.52	4.50	1.25	.11	.16
1947	63,890	8	7.70	.61	5.05	1.50	.22	.32
1948	62,642	10	6.71	.58	4.33	1.32	.28	.20
1949	62,901	7	6.25	.55	4.17	1.07	.29	.17
75,000 tons-over								
1946	107,238	13	6.78	.51	4.80	1.20	.10	.17
1947	101,588	9	7.46	.59	5.16	1.25	.20	.26
1948	112,912	16	6.28	.50	4.29	1.04	.23	.22
1949	115,805	17	5.78	.43	4.02	.92	.20	.21
Total-all mills								
1946	78,620	28	6.70	.52	4.70	1.21	.09	.18
1947	70,151	25	7.59	.62	5.11	1.37	.21	.28
1948	91,949	29	6.38	.52	4.29	1.10	.25	.22
1949	95,988	26	5.88	.46	4.06	.95	.21	.20

Appendix Table V. Relation between the volume of cane ground and the income per 100 pounds of sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive

Tons of cane ground	Average tons ground	Number of mills	Income per 100 pounds of sugar				
			Total receipts	Receipts from sugar	Other receipts	Net Operating Income	Net income
	Tons	Number	$	$	$	$	$
Under 50,000 tons							
1946	44,844	7	7.02	5.73	1.29	.60	.38
1947	41,037	8	7.45	6.19	1.26	—.10	—.37
1948	34,597	3	6.10	5.69	.41	.07	—.17
1949	43,352	2	6.01	5.75	.26	—.13	—.49
50,000-74,999 tons							
1946	61,668	8	6.94	5.92	1.02	.56	.40
1947	63,890	8	7.40	6.22	1.18	.02	—.30
1948	62,642	10	6.13	5.62	.51	—.38	—.58
1949	62,901	7	6.31	5.74	.57	.23	.06
75,000 tons-over							
1946	107,238	13	7.19	6.14	1.05	.58	.41
1947	101,588	9	7.51	6.21	1.30	.31	.05
1948	112,912	16	6.15	5.63	.52	.09	—.13
1949	115,805	17	6.13	5.82	.31	.56	.35
Total - all mills							
1946	78,620	28	7.11	6.04	1.07	.59	.41
1947	70,151	25	7.46	6.20	1.26	.15	—.13
1948	91,949	29	6.14	5.63	.51	—.02	—.24
1949	95,988	26	6.16	5.81	.35	.48	.28

Appendix Table VI. Relation between the yield of sugar obtained per ton of cane and the average costs per 100 pounds of sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive

Pounds of raw sugar per ton of cane Range and year	Average pounds manufactured	Number of mills	Costs per 100 pounds of sugar					
			Total costs	General over-head	Procure-ment of cane	Manu-facture of sugar	Sell-ing	In-terest
Under 150 pounds	Pounds	No.	$	$	$	$	$	$
1946	134.3	7	7.65	.66	5.30	1.45	.04	.20
1947	143.3	11	7.93	.62	5.41	1.41	.21	.28
1948	143.2	13	6.65	.54	4.46	1.17	.25	.23
1949	131.3	2	7.99	.70	5.13	1.40	.36	.40
150 - 159.9 pounds								
1946	154.7	10	6.26	.45	4.52	1.07	.09	.13
1947	154.7	6	7.59	.57	5.08	1.41	.22	.31
1948	154.3	12	6.34	.55	4.26	1.07	.25	.21
1949	153.6	1	6.27	.48	4.18	1.07	.37	.17
160 - 169.9 pounds								
1946	165.3	6	5.97	.41	4.20	1.08	.13	.15
1947	164.6	4	7.19	.77	4.78	1.07	.24	.33
1948	161.4	3	5.93	.43	4.02	1.04	.24	.20
1949	163.9	10	5.83	.44	4.07	.98	.17	.17
170 - 179.9 pounds								
1946	172.6	4	5.86	.56	3.99	1.05	.10	.16
1947	174.0	4	7.07	.58	4.66	1.43	.21	.19
1948	176.0	1	5.40	.38	3.68	.97	.25	.12
1949	174.1	10	5.80	.44	4.04	.89	.22	.21
180 - over								
1946	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-
1949	184.7	3	5.70	.52	3.76	.95	.23	.24
Total - all mills								
1946	154.4	27	6.41	.51	4.51	1.15	.09	.15
1947	153.0	25	7.59	.62	5.11	1.37	.21	.28
1948	151.0	29	6.38	.52	4.29	1.10	.25	.22
1949	168.6	26	5.88	.46	4.06	.95	.21	.20

Appendix Table VII. Relation between the yield of sugar obtained per ton of cane and the income per 100 pounds of raw sugar manufactured, Louisiana sugar mills, 1946 through 1949, inclusive

Pounds of raw sugar per ton of cane Range and Year	Average pounds manufactured	Number of mills	Costs per 100 pounds of sugar				
			Total receipts	Receipts from sugar	Other receipts	Net operating income	Net income
Under 150 pounds	Pounds	No.	$	$	$	$	$
1946	134.3	7	7.50	6.04	1.46	.05	—.15
1947	143.3	11	7.61	6.21	1.40	—.04	—.32
1948	143.2	13	6.18	5.62	.56	—.23	—.46
1949	131.3	2	7.70	5.46	2.24	.11	—.29
150 - 159.9 pounds							
1946	154.7	10	6.68	5.80	.88	.55	.42
1947	154.7	6	7.38	6.21	1.17	.10	—.21
1948	154.3	12	6.13	5.65	.48	.00	—.21
1949	153.6	1	6.14	5.74	.40	.04	—.13
160 - 169.9 pounds							
1946	165.3	6	6.56	5.73	.83	.74	.59
1947	164.6	4	7.31	6.21	1.10	.45	.12
1948	161.4	3	6.10	5.63	.47	.37	.17
1949	163.9	10	6.12	5.80	.32	.46	.29
170 to 179.9 pounds							
1946	172.6	4	6.58	5.88	.70	.88	.72
1947	174.0	4	7.37	6.20	1.17	.49	.30
1948	176.0	1	6.09	5.61	.48	.81	.69
1949	174.1	10	6.12	5.84	.28	.53	.32
180 pounds - over							
1946	—	0	—	—	—	—	—
1947	—	0	—	—	—	—	—
1948	—	0	—	—	—	—	—
1949	184.7	3	6.06	5.84	.22	.60	.36
Total - all mills							
1946	154.4	27	6.81	5.85	.96	.55	.40
1947	153.0	25	7.46	6.20	1.26	.16	—.13
1948	151.0	29	6.14	5.63	.51	—.02	—.24
1949	168.6	26	6.16	5.81	.35	.48	.28

Appendix Table VIII. Geographic variations in the financial results obtained from the operation of sugar mills in Louisiana for the years 1946 through 1949, inclusive—for the Teche and Mississippi Regions

Items of cost and returns	**Average per 100 pounds of sugar**							
	Teche Region				**Mississippi Region**			
	1946	**1947**	**1948**	**1949**	**1946**	**1947**	**1948**	**1949**
	$	$	$	$	$	$	$	$
General overhead	.51	.69	.58	.48	.52	.57	.49	.44
Procurement of cane	4.34	5.07	4.28	4.06	4.99	5.13	4.29	4.05
Manufacture of sugar	1.12	1.37	1.05	.90	1.28	1.37	1.14	.99
Selling	.09	.26	.28	.25	.10	.19	.23	.18
Interest	.17	.34	.25	.23	.18	.24	.19	.19
Total	6.23	7.73	6.44	5.92	7.07	7.50	6.34	5.85
Misc. credits	.89	1.18	.44	.24	1.22	1.32	.56	.43
Net cost	5.34	6.55	6.00	5.68	5.85	6.18	5.78	5.42
Receipts:								
Raw sugar	5.83	6.21	5.64	5.83	6.19	6.20	5.63	5.79
Misc. credits	.89	1.18	.44	.24	1.22	1.32	.56	.43
Total income	6.72	7.39	6.08	6.07	7.41	7.52	6.19	6.22
Operating expenses	6.06	7.39	6.19	5.69	6.89	7.26	6.15	5.66
Net operating income	.66	0.00	—.11	.38	.52	.26	.04	.56
Net income	.49	—.34	—.36	.15	.34	.02	—.15	.37
Capital investment	3.47	6.71	4.96	4.52	3.07	4.80	3.87	3.81
Pounds of sugar mfg. per ton of cane	159.0	154.9	149.7	171.0	143.2	152.4	151.9	167.0

,E5b

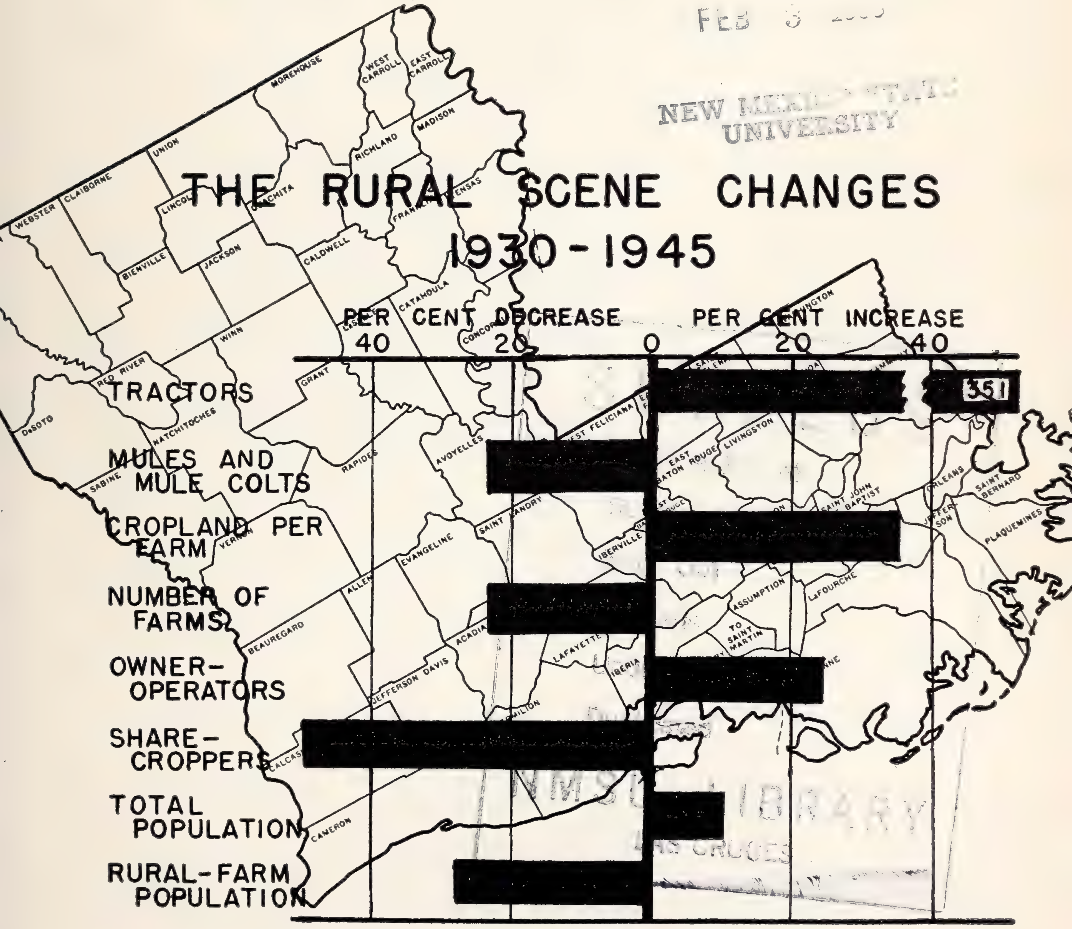
Louisiana Bulletin No. 458 June, 1951

AGRICULTURAL MECHANIZATION AND SOCIAL CHANGE IN RURAL LOUISIANA

By

Alvin L. Bertrand

LIBRARY
FEB 8 ...
NEW MEXICO STATE UNIVERSITY



NMSU LIBRARY
LAS CRUCES

LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION

W. G. Taggart, Director

Table of Contents

PREFACE 5

I. INTRODUCTION 6
  Objectives 7
  Methodology 8

II. MOTIVATING FORCES IN AND REACTIONS TO MECHANIZATION 12
  Reasons for Mechanizing 12
  The Role of Age, Education, and Size of Farm in Mechanization 16
  Reasons for Not Mechanizing 18
  Non-Operator Reactions to Mechanization 21

III. MECHANIZATION AND SOCIAL CHANGE 24
  Socio-Economic Changes 25
    Changes in Machinery and Equipment 25
    Changes in Numbers of Mules and Other Livestock . . . 27
    Changes in Tenure 28
    Changes in Number and Sizes of Farms 33
    Changes in Production and Levels of Living 35
  Other Social Changes 37
    Population Changes 37
    Changes in Social Institutions 40
    Changes in Social Participation, Health, and Happiness 45
    Changes in Town-Country Relations 47

IV. CONCLUSIONS 47

V. SUMMARY 48

LIST OF TABLES

I. Changes in Numbers of Tractors in Louisiana, 1930-1945 . . . 7

II. Number of Tractors and Value of Implements and Machinery Related to Land in Cultivation, by Mechanization Groups, Louisiana, 1945 9

III. Age, Education, and Size of Farm Related to Motivating Factors in Mechanization, 1950 17

IV. Intentions of Non-Mechanized Operators With Respect to Mechanization, by Mechanization Groups, Louisiana, 1950 19

V. Non-Operator Interviewee Reactions to Mechanization, by Mechanization Groups, Louisiana, 1950 22

VI. Changes in Numbers of Selected Livestock and Chickens, by Mechanization Groups, Louisiana, 1930-1945 28

VII. Changes in Numbers of Owner-Operated Farms in Louisiana, by Mechanization Groups, 1930-1945 29

VIII. Changes in Selected Tenure Groups, by Mechanization Groups, Louisiana, 1930-1945 29

IX. Changes in Numbers of Farm Wage Laborers, 1930-1940, and Croppers, 1930-1945, in Louisiana, by Mechanization Groups 32

X. Percentage of Farms Operated by Non-Residents, by Mechanization Groups, Louisiana, 1940-1945 33

XI. Changes in Total Acreage and Cultivated Acreage Per Farm, by Mechanization Groups, Louisiana, 1930-1945 35

XII. Changes in the Percentage of the Total Value of Farm Products Used by Households, by Mechanization Groups, Louisiana, 1940-1945 35

XIII. Percentage of Farms With Specified Level of Living Items, by Mechanization Groups, Louisiana, 1945 36

XIV. Age Distribution of the Rural Farm Population, by Mechanization Groups, Louisiana, 1940 39

XV. Changes in Sex Distribution of the Rural Farm Population, by Mechanization Groups, Louisiana, 1930-1940 39

XVI. Interviewee Opinions Regarding Certain Changes in Rural Social Institutions and Processes in the Last 15 Years, by Mechanization Groups, Louisiana, 1950 41

XVII. Percentage of Rural-Farm Population 25 Years Old and Over Having Completed High School, by Mechanization Groups, Louisiana, 1940 43

XVIII. Fertility Ratio of Rural-Farm Population, by Mechanization Groups, Louisiana, 1940 44

LIST OF FIGURES

1. Map of Louisiana Showing the Parishes According to Mechanization Group and the Location of the Four Survey Areas, 1950 10
2. Proportions of Mechanized Farm Operators Interviewed Who Reported Specific Reasons for Mechanizing, Four Survey Groups, Louisiana, 1950 13
3. Proportions of Non-Mechanized Farm Operators Interviewed With No Intentions to Mechanize Reporting Specific Reasons for Their Decision, Four Survey Groups, Louisiana, 1950 21
4. Changes in the Numbers of Tractors and Trucks and Value of Implements and Machinery Related to Cultivated Acreage, by Farm Mechanization Groups, Louisiana, 1930-1945 26
5. Changes in the Numbers of Mules and Mule Colts on Farms, by Mechanization Groups, Louisiana, 1930-1945 27
6. Changes in the Number of Farms, by Mechanization Groups, Louisiana, 1930-1950 34
7. Changes in the Rural-Farm Population, by Mechanization Groups, Louisiana, 1930-1945 38
8. Persons per Doctor, by Mechanization Groups, Louisiana, 1950 . . 46

Preface

For the past two decades interested persons have noted significant changes taking place in the rural areas of Louisiana. These changes, apparently, were tied rather closely to an increased use of machines by farmers. Lacking empirical evidence, however, observers could only speculate with regards to causal relations. This study, made under the supervision of the Louisiana Agricultural Experiment Station, is an attempt to provide, in a systematic and meaningful form, factual data for interpretations of the above nature. It is primarily addressed to those persons at the local, state, and regional level who have an interest in or a responsibility for agricultural planning programs. It is hoped, however, that many other persons will find the material presented of value.

The exploratory nature of the study precluded thorough analysis of any single association or change which is pointed out. Such, in fact, would not have been realistic in view of the need of specialized studies for basic groundwork upon which to build. It is hoped, however, that more intensive study of particular phenomenon, called attention to by the present report, will be forthcoming.

The information for this study was obtained for the most part from the Federal Census and a Field Survey. It is discussed under three broad subjects. The first deals with the advent and progress of agricultural mechanization in the various areas of the state. This part of the report presents the particular state or stage of agricultural mechanization in each parish within Louisiana. The second topic discussed is the motivating forces in and reactions to mechanization. This section concerns itself with the reasons why farmers have or have not mechanized and the reactions of both farm operators and non-operators to mechanization. The third major discussion topic deals with mechanization and its relation to social change. It devotes itself to the inter-connection between the coming of machines and socio-economic changes, as well as to social change in rural areas *per se*.

The efforts of many persons, in one way or another, have contributed to the preparation of this report. Special thanks are due Director W. G. Taggart of the Louisiana Agricultural Experiment Station who made the study possible and continually expedited its progress; Dr. T. Lynn Smith, former Head of the Departments of Sociology and Rural Sociology at Louisiana State University, who originally conceived the idea for the study and set it up as a research project; Dr. Homer L. Hitt, Head of the Departments of Sociology and Rural Sociology at Louisiana State University, who made numerous and indispensable contributions of all kinds throughout the course of the study; and Dr. Paul H. Price of the Department of Rural Sociology who gave valuable editorial assistance and encouragement to the writer. To these, and all the others who have helped in any way to bring the report to a successful completion, the author wishes to express his sincere thanks.

Agricultural Mechanization and Social Change in Rural Louisiana

By Alvin L. Bertrand
Department of Rural Sociology
Louisiana Agricultural Experiment Station

I. INTRODUCTION

Agriculture in the South is in an era of change. It is undergoing what might well be termed a "technological" revolution. This fact has been acknowledged by almost every writer or speaker on the southern region within the last ten years. Observers, however, seemingly have been so absorbed in the chronicling of this trend that they have, with few exceptions, overlooked causation and social and economic implications.[1] Present developments make it evident that the above considerations merit the immediate attention of the social scientists of the region. This fact is emphasized by Ogburn and Nimkoff. They state:

> Mechanization is one of the most striking and pervasive phenomena of our times. Unfortunately, its study has been neglected by the social sciences, which have not sufficiently recognized that while technology itself belongs to the field of the natural sciences, its far-reaching effects on social life make it a vital subject for study by the social sciences.[2]

Already it is obvious that changing techniques in agriculture have drastically altered the economic nature of farming itself and have been responsible for profound changes in rural social institutions. Over and beyond this, problems have appeared which stem from the dislocation of populations. The above facts set the stage for the following research report.

More specifically, the present study is an attempt to answer questions in connection with the relatively sudden advent and spread of agricultural mechanization in Louisiana. How quickly the change has come about may be seen in Table I, which shows the increase in the number of tractors in the state in the last 15 years. Since this is one of the first works of its kind to appear, the procedure is exploratory to a high degree. It is felt, however, that sufficient information is presented to answer many of the questions which have been raised. At the same time, the findings should be useful in predicting trends—an important task—as mechanization in the state is far from its peak and will presumably continue to advance at a fairly rapid pace.

---

[1] The above does not mean to imply that there has been no study of the social effects of the mechanization of southern agriculture. On the contrary, several scholars have done commendable jobs of taking inventories of the immediate social effects and of hypothesizing on possible changes of the future. For some examples, see: C. Horace Hamilton, "The Social Effects of Recent Trends in the Mechanization of Agriculture," *Rural Sociology,* IV (1939), 3-19; Arthur Raper, "The Role of Agricultural Technology in Southern Social Change," *Social Forces,* XXV (1946), 21-30; B. O. Williams, "The Impact of Mechanization of Agriculture on the Farm Population and the South," *Rural Sociology,* IV (1939), 300-313; Rupert Vance, *All These People,* Chapel Hill: The University of North Carolina Press, 1945, and *Wanted: The South's Future for the Nation,* Atlanta: Southern Regional Council, 1946; and Robert T. McMillan, *Social Aspects of Farm Mechanization in Oklahoma,* Stillwater: Oklahoma Agricultural Experiment Station Bulletin No. B-339, 1949.

[2] William F. Ogburn and Meyer F. Nimkoff, *Sociology,* Second Edition, New York: Houghton Mifflin Company, 1950, p. 52.

TABLE I. CHANGES IN THE NUMBERS OF TRACTORS IN LOUISIANA, 1930-1945

Census Year	Number of Tractors	Per Cent Increase Over Previous Census Year
1930	5,016	....
1940	9,476	88.1
1945	17,630	86.2

Source· Sixteenth Census of the United States, 1940, and United States Census of Agriculture, 1945.

Objectives

The major objectives of this study may be listed as follows: The first was to discover how far mechanization had progressed in the various areas of the state. Information of this sort is not only important to the State Agricultural Extension Service and Agricultural Experiment Station but to persons in private and public life concerned with Louisiana agriculture. Also, a knowledge of the extent and degree of mechanization in each area of the state will shed light on the factors associated with the acceptance and diffusion of technological improvements in rural areas of the southern region.

The second purpose was to acquire information relative to underlying causes for the rapid shift to mechanization by southern farmers. In this connection, knowledge was sought at two levels, i.e., regional as well as local. The aim was an understanding, not only of the over-all developments related to the advent of machines in southern fields, but the actual reasons of farm operators for mechanizing. Information on reactions to mechanization was considered relevant in this connection. Agriculturalists and others who possess this information will, of course, be in an advantageous position to understand what has happened and in appraising possible future changes on the farm scene.

A third objective, and perhaps the major one of the study, was to find out, insofar as possible, the number and nature of socio-economic changes in agricultural areas of Louisiana which are attributable to the adoption of mechanical power on farms. It is known, as has been mentioned, that the abruptness and speed of southern agriculture's shift to machines has already created some problems and others may be anticipated. Such information, then, is of significant value to many people.

Finally, it was felt that there might exist certain social changes in rural areas of Louisiana not clearly attributable to mechanization or, for that matter, to any other single factor, yet representing phenomena of great importance. Consequently one objective of the study was to point out changes of a social nature occurring in the rural areas of the state. It was believed that this objective could be carried out incidental to the presentation of the role of mechanization in social change. Such knowledge, of course, is of use in appraising the sum total of change and can be invaluable to agricultural planners.

Methodology

Since this study is one of the first of its kind, there was little precedence to follow.[3] The first task undertaken was the assembling and tabulating of basic relevant data from the Federal Census. After review of these materials, it was felt that many questions were not explained and could only be answered by a field study. To determine what direction such a study should take, a list of questions pertaining to the advent and effects of mechanization and social change was sent to every county agent in the state. The response to these questions was gratifying, and ample information for the development of a field schedule was obtained.

Census data and county agent reports indicated wide differences in degree of mechanization from one part of the state to another. Therefore, it was deemed desirable to make a sounding in as many different localities as possible. The problem was to select a valid and reliable index of farm mechanization so that sample enumerations would represent the state or stage of mechanization in a given group of parishes within the state. This problem was complicated by the fact that a realistic definition of mechanization must include the shift from hand or horse power to combustion engine or electric power in any part of the operation of the farms instead of just in the fields.

In the preliminary work to decide upon an appropriate index, many measures of mechanization appearing in the 1945 Census of Agriculture were tested. After careful analysis, it was decided that, in view of the above definition of mechanization, no one index would suffice. Rather a combination of two, the number of tractors per 1,000 acres of cropland and the dollar valuation of implements and machinery per acre of cropland, was selected as most satisfactory. Acres of cropland instead of land in farms was used as the bases of the indices because of the many acres of land not utilized on some farms.

The procedure for determining Farm Mechanization Groups was to array parishes according to the two indices named above and arbitrarily divide the 64 parishes of the state into four groups. The parishes having the highest indices were placed in Group I, those with the second highest in Group II, those with the third highest in Group III, and those with the smallest in Group IV. In the few parishes where the indices indicated different categories, an intermediate position was selected. For example, if the number of tractors per 1,000 acres of cropland indicated Group I and the dollar valuation of implements and machinery per cultivated acre indicated Group III, the parish was placed in Group II. The parishes in each Mechanization Group are shown in Figure 1. Table II shows the difference in numbers of tractors and value of implements and machinery for each group.

---

[3] The most helpful study to the writer was McMillan, *op. cit.*

It is interesting to note that, although there are clusters of parishes in each Mechanization Group, individual parishes may differ considerably in degree of mechanization from their neighbors. Also, it is significant that certain parishes which have traditionally been looked upon as the most highly mechanized in the state do not appear in Mechanization Group I. The answer lies in the fact that averages for the parish are used rather than for types of farms. For example, a few rice farms in a given parish may be highly mechanized while the majority of general farms in the parish are not.

As may be seen in Figure 1, the most highly mechanized parishes of the state (Group I) center in what is commonly known as the Sugar parishes of south Louisiana and include contiguous parishes in the Truck and Citrus Belt. The two exceptions are the parishes of Rapides in the central part of the state (a cane and cotton parish) and Tangipahoa, in the southeastern part of the state (a small-fruit and dairying parish). The high concentration of mechanization in this part of south Louisiana may come as a surprise to those persons accustomed to thinking of the southwest Louisiana rice areas as the most highly mechanized. Actually, as has been pointed out, the large rice farms are highly mechanized, but the small family farms scattered throughout the rice growing

TABLE II. Number of Tractors and Value of Implements and Machinery Related to Land in Cultivation, by Mechanization Groups, Louisiana, 1945

Farm Mechanization Group	Tractors per 1,000 Cultivated Acres	Implements and Machinery per Cultivated Acre
State	3.4	$11.87
Group I	5.9	20.15
Group II	4.6	13.39
Group III	3.0	10.95
Group IV	1.4	7.26

Source: United States Census of Agriculture, 1945.

region are not. Thus, the average for the individual parishes is brought down.

The second highest one-fourth of the parishes according to the mechanization index (Group II) are somewhat scattered. One grouping of these parishes is found along the Mississippi River in the area traditionally characterized as having a cotton-plantation economy. A second concentration appears along the lower tier of the so-called Florida parishes in southeast Louisiana. The latter is a region of family farms growing specialized crops quite unlike the Mississippi River Delta Cotton Area. Three of the rice parishes, Acadia, Vermilion, and Calcasieu, and one bordering parish, Beauregard, are included in this group. Also included is one family-farm parish, Grant, and one north Louisiana fringe parish (located between the Upland Cotton and Mississippi Delta Cotton Areas), Ouachita.

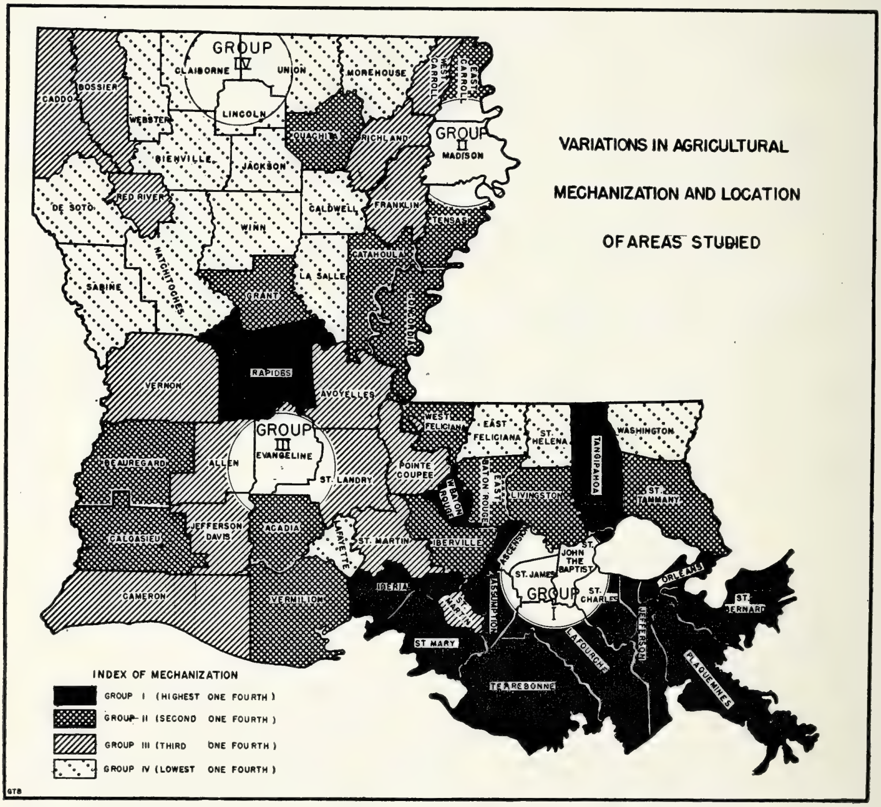


FIGURE 1. Map of Louisiana Showing the Parishes according to Mechanization Group and the Location of the Four Survey Areas, 1950.

The third highest one-fourth of the parishes (Group III) includes the remaining parishes of southwest Louisiana, the mixed-farming parishes adjacent to the rice area, three Red River Delta parishes (Caddo, Bossier, and Red River), and four outer Mississippi River Delta parishes (West Carroll, Richland, Franklin, and Avoyelles).

All of the least mechanized parishes, except for three included in the upper tier of the Florida parishes (East Feliciana, St. Helena, and Washington) and one south central parish (Lafayette) are located in the north and central Louisiana Hill and Cut-over areas. Cotton growing, subsistence and general farming, and forest-products industries are the chief activities of the rural people in these regions.

To satisfy the requirement for obtaining a representative sample in each group of parishes representing a particular state of mechanization, the following procedure was used. Four circular survey areas with a 30-mile radius were selected, each with its midpoint located as near as possible to the center of the largest cluster of parishes falling in a particular Mechanization Group. With the exception of a few persons not available for interview, every farm operator and non-operator with a 10-year history of continuous residence within the sample areas, regardless of race, was interviewed by a carefully trained enumerator. In this connection, it should be noted that operator and non-operator schedules were of a necessity not identical. Many of the same questions were asked each group of interviewees, however. The survey schedules called for a considerable variety of information, although an attempt was made to keep the time required for interviews reasonably short. Altogether 485 schedules were taken. Of these, 275 were from farm operators and 210 from non-operators. The distribution of operator schedules was as follows: 55 in Group I parishes, 54 in Group II parishes, 82 in Group III parishes, and 84 in Group IV parishes. Sixty-three non-operator schedules were taken from Group I parishes, 72 from Group II parishes, 35 from Group III parishes, and 40 from Group IV parishes.

The information obtained from the Census and the survey was sorted and tabulated in the conventional manner. Comparisons by Mechanization Groups are emphasized because these are considered the most significant for the purposes of the study. In this connection, differentials such as race, religion, etc., while not maintained in the data, are used in making interpretations. Where comparable data from the Census and the survey are available, both are used in the analysis for the sake of a clearer and more up-to-date picture. The analysis is simple and straightforward. For comparative purposes, the Census data for 1930 and 1945 are used whenever available, as this period is the most important in the change to mechanization. Because of the facility with which the presentation of data can be made by graphs, some of the information is presented in this manner.

II. MOTIVATING FORCES IN AND REACTIONS TO MECHANIZATION

As has been observed, it is common knowledge that southern agriculturists had, for the most part, ignored machinery for many years after mechanization had become widespread in other regions of the United States. Why this should have been true is not too easily explained. There is evidence, however, that the lag was related to several factors, including slavery, immigration differentials, the "factory" system of the plantations, and a plentiful supply of low-cost labor.[4] Because of the traditional reliance on hand labor and horse or mule power, the first large-scale observance of machines on southern fields caused observers to pose several challenging questions. One such question asked why farmers suddenly turned to mechanization. In attempts to answer this query, casual observers, noting the coincidence of the depression beginning in 1929-30 with the advent of machines, have had a tendency to assign a direct causal relation between the two phenomena. It may be shown, however, that such an analysis is in error and that the turn to technology on the part of southern farmers is more clearly attributable to other factors.[5] Particularly important among the factors responsible for mechanization are the social processes set in motion by the unionization of agricultural laborers, then strengthened by landlord adjustment to the AAA program, and finally, brought to a climax by the mass abandonment of the fields by the laborers during World War II.[6] However, while the above reasons suffice for a general explanation of the phenomenon, it is necessary to go further into the matter for a detailed picture. In this connection, the responses of operators of mechanized farms to the question, "What was the chief motivating factor in your decision to mechanize?" are revealing. An analysis of the answers to this question appears below.

Reasons for Mechanizing

Thinking in terms of the exodus of farm workers during World War II, many persons have expressed the belief that farmers of the state would name a shortage of labor as the prime cause of their shift away from the long-used "mule technology." In view of this belief, it is significant that the farm operators interviewed, who were mechanized, most frequently named economy as the primary reason for their changeover to their present set-up. In fact, two out of every five reasons mentioned, as can be seen in Figure 2, dealt in some way with economy. Statements such as, "I can work more land with less labor," "It's cheaper,"

---

[4] For a more detailed explanation, see Alvin L. Bertrand, "The Social Processes and Mechanization of Southern Agricultural Systems," *Rural Sociology*, XIII (1948), 31-39.

[5] See: *Ibid.*

[6] *Ibid.*

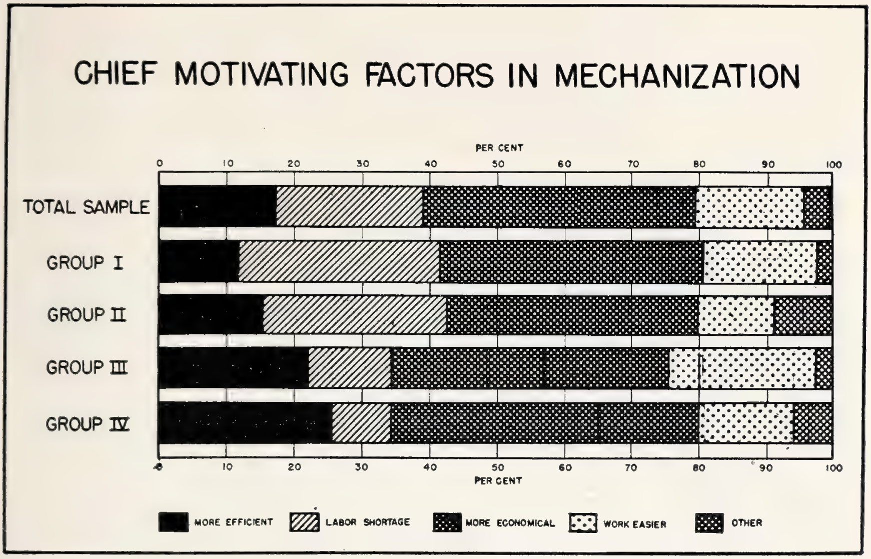


FIGURE 2. Proportions of Mechanized Farm Operators Interviewed who Reported Specific Reasons for Mechanizing, Four Survey Groups, Louisiana, 1950.

"More economical," and "Faster and better," were heard frequently. They testify to the farmers' interest in economy. In this connection, it should be noted that farm management studies have determined that mechanized operations are more economical on most farms, regardless of size.[7] Of course, it is logical to assume that labor shortage has had an indirect bearing on the economic factor. That is, because of a shortage, labor became high priced, which placed machines in a more favorable competitive position. On the other hand, it should also be pointed out that on certain types of farms, and on family-size farms in general, labor has never been a critical item. This latter point is brought out in a comparison of the responses of interviewees from the different Mechanization Groups. Although economy was named as the most important reason for mechanizing in all groups, it was given more importance, in comparison to labor shortage, by farmers in Groups III and IV, who are generally on family-size farms.

The second most important reason for mechanization listed by the farm operators interviewed was labor shortage. Over one-fifth of all reasons mentioned included some reference to this factor. Remarks such as "Couldn't get labor and was forced into it [mechanization]," and

---

[7] See Frank D. Barlow and Leo J. Fenske, *Tractors on Upland Farms in North Louisiana*, Baton Rouge: Louisiana Agricultural Experiment Station Bulletin No. 399, 1945, and Frank D. Barlow and Leo J. Fenske, *Cost and Utilization of Power and Equipment on Farms in the Mississippi River Delta Cotton Area of Louisiana*, Baton Rouge: Louisiana Agricultural Experiment Station Bulletin No. 417, 1947.

Mechanization has not only reached the large farm . . .

. . . but the small farm as well.

"Couldn't get labor at the price they [laborers] wanted," were common. It is interesting, as was noted above, to discover that there is a direct association between degree of mechanization in the groups studied and the importance of labor shortage in forcing mechanization. For example, in Group II, centering in the Mississippi Delta Cotton Area, almost one-third of the reasons cited had to do with labor shortage as compared with less than one-tenth in Group IV, centering partly in the Upland Cotton Area of north Louisiana.

The third ranking factor in mechanization according to the total sample of operator-interviewees is the efficiency of the machine. In other words, such advantages of the tractor as the ability to plow deeper, break new land more efficiently, and control certain weeds more effectively were mentioned by several farmers as reasons for forsaking draft animals. Of all answers given, 17.6 per cent were classifiable under this heading. It is interesting to see that the pattern of responses with respect to this factor shows an inverse correlation between degree of mechanization and number of times the factor is mentioned. Efficiency is especially stressed by operators in Group IV. Apparently the fact that tractors have been proved to have an advantage in the control of Johnson grass has sold a good many farmers in this group on them.

A fourth motivating factor of some importance is the fact that machine work is easier on the operator. Almost anyone can appreciate the fact that riding is easier on the individual than walking, and that handling a steering wheel is easier than maneuvering plow handles. Many farmers admit quite readily that this fact had much to do with their decisions to mechanize. In fact, almost one-sixth of the reasons for the change to mechanization of operators making the transition were classifiable under this heading. Typical comments in connection with this factor were as follows: "Faster, lighter, and not as hard on the farmer," "Too hard to work with mules," "Too old to follow mules anymore," "Much easier on me." Some respondents went so far as to make statements such as "Wouldn't stay in farming if it were not for machines."

With regards to the motivating forces in mechanization, it was deemed important to learn if those persons who had mechanized were, after some experience with them, completely sold on their machines. Such a question was put to every mechanized operator. As large a percentage as 92.3 of these persons expressed complete satisfaction with their equipment. Interestingly enough, those persons not completely happy expressed dissatisfaction with the high cost of mechanized equipment and the lack of skilled labor to operate the equipment rather than with the equipment itself. These findings indicate that there would be no widespread return to old methods even with the return of a plentiful supply of low-cost labor.

The Role of Age, Education, and Size of Farm in Mechanization

The factors which might influence the decision of farm operators to mechanize are admittedly complex. Not unimportant are the cultural influences stemming from the roles which the individual plays and the groups to which he belongs. These types of experiences color the thinking of participants and help to determine their characteristic reactions and habit systems. It is not far-fetched, therefore, to expect the age and education of a farm operator to condition his experiences and to influence his decisions to mechanize. The magnitude of farming operations of the individual would have similar effects. Relationships between the age, education, and size of holdings of operator-interviewees and their reasons for mechanizing are explored below.

The tabulations in Table III reveal an interesting inter-connection between age and the factors of economy and labor shortage. The younger operators are definitely more concerned with economy than the older operators. In contrast, the farmers 61 years of age or over more often shifted to machines because of a labor shortage. Several explanations for the above patterns of association come to mind. (1) Young men are just starting out and because of necessity are sold on economy. (2) The older men have more experience with the use of farm labor and consequently are more in a position to appraise the effects of a shortage of labor. (3) Older men have had more opportunity to accumulate large holdings. On such farms labor is more critical. The relationships between age and the other factors which have been mentioned are not close enough to warrant conclusions.

The role of education in motivations to mechanize are not so obvious as those of age. The data show, however, that the operators with college-level educational experience more often named economy and labor shortage. On the other hand, while fewer persons going beyond high school specified efficiency as the prime cause of their shift to modern equipment, no one at this level posed the fact that farm work was easier with machines, or other miscellaneous reasons in this light. The deduction may be made that the better educated persons are more apt to be rational and deliberate in their actions.

It has been stated previously that labor was a more critical item on larger farms. This is affirmed by the relationship between size of farms of operators and their statements that labor shortage was the most important reason for their mechanizing. With the exception of a slightly higher percentage of persons operating farms of less than 80 acres than of those operating farms ranging from 81-160 acres, the correlation between size of farm owned and proportion of operators mentioning labor shortage is direct. In view of this, it is interesting to note that variations in percentages of persons in each size-group naming economy are not too great and follow no particular pattern. On the other hand, the persons

TABLE III. AGE, EDUCATION, AND SIZE OF FARM RELATED TO MOTIVATING FACTORS IN MECHANIZATION, 1950

Age, Education and Size of Farm Groups	Motivating Factors									
	More Economical		Labor Shortage		More Efficient		Easier		Other	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Age										
0–40 years	24	48.0	5	10.0	11	22.0	8	16.0	2	4.0
41–60 years	28	43.7	18	28.1	8	12.5	6	9.4	4	6.3
61 years and over	5	20.0	10	40.0	6	24.0	3	12.0	1	4.0
Education										
0–7 years	23	41.8	8	14.5	12	21.8	10	18.2	2	3.7
8–12 years	24	37.5	18	28.1	10	15.6	7	10.9	5	7.8
13 years and over	10	50.0	7	35.0	3	15.0	..	....	..	....
Size of farm										
0–80 acres	13	38.3	5	14.7	8	23.5	5	14.7	3	8.8
81–160 acres	12	38.7	4	12.9	7	22.6	7	22.6	1	3.2
161–500 acres	14	43.7	5	15.6	5	15.6	5	15.6	3	9.4
501–1000 acres	4	36.3	4	36.4	3	27.3	..	....	..	....
1001–2500 acres	11	52.4	8	38.1	2	9.5	..	....	..	....
2501 acres and over	3	37.5	7	62.5	..	....	..	....	..	....

on smaller farms apparently are more concerned over efficiency, the comparative easiness of machine work, and other reasons. The latter is significant because it sheds light on the question of whether or not farmers on larger farms are being forced to mechanize. In view of the above patterns of response, the conclusion must be that these farmers, for one of two reasons, have been forced to turn to technology. With some exceptions, competition or scarce and high-priced labor has made it necessary for large operators to economize.

Reasons for Not Mechanizing

In a study such as the present one it is, of course, just as important to study negative reactions as positive reactions. In this regard, the reasons why some farm operators have not followed their neighbors in utilizing power machines have also been the subject of much speculation. To shed some light on this question, three queries were directed toward all operators who were not using power, other than horse or mule, enough to be recognized as mechanized.

At this point, it should be noted that 46.5 per cent of the operators interviewed were classified as non-mechanized. As would be expected, the proportion of the total number of operator-interviewees not mechanized is inversely correlated with Mechanization Groups. Respectively, 9.0 per cent of Group I, 37.0 per cent of Group II, 57.3 per cent of Group III, and 66.7 per cent of Group IV operators were not utilizing technological improvements to an appreciable extent. This is a confirmation of the validity of the indices used in determining Mechanization Groups.

The first question of the above mentioned series was "If not mechanized, are you intending to shift to machines at the first opportunity?" Obviously, the intent in asking such a question was to discover the number of farm operators not sold on mechanization. An analysis of the responses to this query shows definite and enlightening opinions on mechanization. Of the 128 non-mechanized operator-interviewees, only three were undecided as to their future course of action. Over one-third (35.2 per cent) were definitely intending to use machines at the first opportunity, but over three-fifths (63.3 per cent) were just as firm in their intentions to continue as they were. More opposition to mechanization appeared among the least mechanized farmers. See Table IV.

The second question was directed only to those persons expressing an intention to mechanize and was a follow-up to the first question. It read as follows: "If you are intending to mechanize, what has held you up?" For all practical purposes it may be stated that the lack of necessary finances is the chief deterrent factor in the way of those farmers who have not mechanized but wish to do so. Ninety-three per cent of this group named finances as the thing which had held them up. A few, 2.3 per cent, replied that their farms were too small in size to successfully utilize machines. However, in these instances, the assumption may be made that if they had the necessary capital they could acquire the

TABLE IV. INTENTIONS OF NON-MECHANIZED OPERATORS WITH RESPECT TO MECHANIZATION, BY MECHANIZATION GROUPS, LOUISIANA, 1950

Farm Mechanization Group	Intentions With Respect to Mechanization					
	Yes		No		Undecided	
	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total Sample	45	35.2	81	63.3	2	1.5
Group I	2	40.0	3	60.0	0	. . .
Group II	10	50.0	10	50.0	0	. . .
Group III	19	40.4	28	59.6	0	. . .
Group IV	14	25.0	40	71.4	2	3.6

needed land. The remaining two persons unaccounted for did not respond to the question.

The final question in the series was directed to farmers who had not mechanized and did not intend to do so. It inquired as to the reasons for this decision. Surprisingly enough, the most frequently cited factor was age. See Figure 3. Almost one-third (31.6 per cent) of these persons feel they are too old to shift from their routines of operation. Farmers in Group IV, especially, seem convinced that they are too old to change. How much rationalization is involved in a response of this nature is of course a matter of speculation. No doubt some persons did rationalize by mentioning age instead of lack of finances. The capital outlays required to mechanize also are important in the decision of those persons having no plans in the direction of mechanization. Over one-fourth (26.6 per cent) of the reasons given indicated a lack of necessary finances and little hope of ever acquiring such funds. An additional 22.8 per cent stated that their farms were too small. Again, it might be suggested that lack of finances is implied in such an answer.

The discovery that over one-tenth (11.4 per cent) of these respondents had not changed to mechanization because they were satisfied with or preferred animals is an enlightening one. Almost all of the responses of this nature came from family-sized farm areas. No doubt there are some sound reasons behind such feelings, but, at the same time, it is possible to detect a hesitancy to depart from the traditional. The final reason of enough magnitude to merit individual treatment is, interestingly enough, the lack of skilled labor to operate machines. While only six interviewees named this factor, it indicates knowledge of dissatisfaction on this point by mechanized persons. This fact is confirmed elsewhere in the present report.

Although some farmers have not turned to mechanization . . .

. . . machinery dealers are confident it is but a matter of time.

—Photo by A. V. Patterson

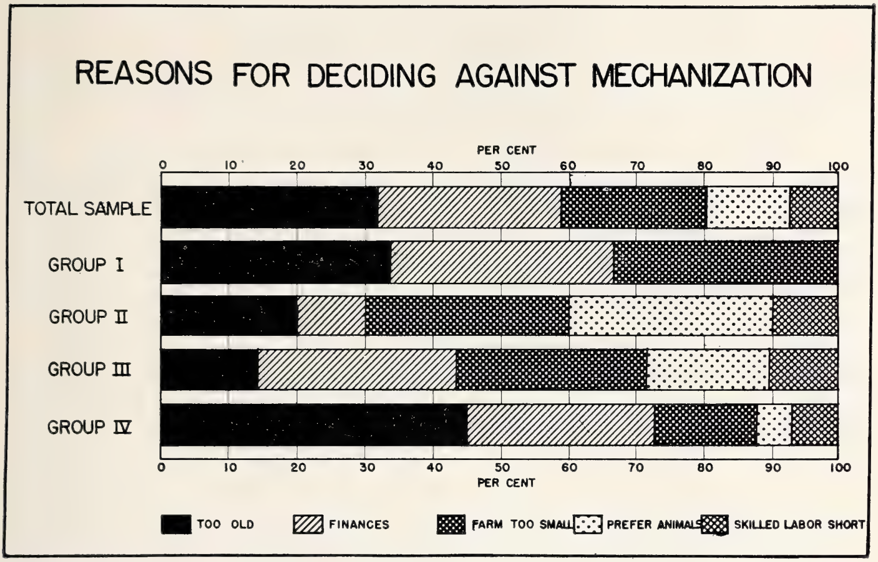


FIGURE 3. Proportions of Non-Mechanized Farm Operators Interviewed With No Intentions to Mechanize Reporting Specific Reasons for their Decision, Four Survey Groups, Louisiana, 1950.

Non-Operator Reactions to Mechanization

In the preceding discussion, the reactions of farm operators to mechanization were analyzed. There is another group which is, if anything, more vitally concerned with the changes which are taking place in southern agriculture. This group includes the non-operators, or those persons not having managerial responsibility in the operation of farms. The non-operators are the ones who must compete directly with the machines and who, apparently, should have strong feelings about mechanization. In view of this fact, it was deemed important to get their verbal reaction to mechanization. All such interviewees were asked two questions as follows: (1) "What is your opinion of mechanization?" and (2) "Would you prefer to work on a mechanized farm?"

The responses to these questions were tabulated by Mechanization Groups and appear in Table V. Some of the findings are interesting in the light of the expressed role of machines in displacing agricultural laborers. Of special significance, however, are the correlations between degree of mechanization and opinions of mechanization. Clearly non-operators in the most highly mechanized areas have had more opportunity to form an opinion on mechanization. This is shown in the percentage of each Mechanization Group reporting that they had no opinions or were undecided on the first question. Only 6.4 per cent of the Group I respondents gave such an answer, as compared with 12.5 per cent of Group II, 31.4 per cent of Group III, and 42.5 per cent of

TABLE V. NON-OPERATOR INTERVIEWEE REACTIONS TO MECHANIZATION, BY MECHANIZATION GROUPS, LOUISIANA, 1950

Farm Mechanization Group	Opinion of Mechanization						Preference for Work on Mechanized Farm					
	Favorable		Unfavorable		Undecided		Yes		No		Undecided	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Total Sample	135	64.3	34	16.2	41	19.5	132	62.0	71	33.3	10	4.7
Group I	46	73.0	13	20.6	4	6.4	43	68.3	18	28.5	2	3.2
Group II	49	68.1	14	19.4	9	12.5	46	63.1	24	32.8	3	4.1
Group III	22	62.9	2	5.7	11	31.4	23	66.6	11	31.4	1	2.9
Group IV	18	45.0	5	12.5	17	42.5	20	50.0	18	45.0	4	5.0

Group IV non-operator interviewees. Again a verification of the mechanization index used is found in the pattern of responses. The data in Table V show a positive correlation between degree of mechanization and favorable opinions of mechanization. Almost three-fourths of Group I interviewees were favorable toward technological improvements, while slightly more than two-thirds of Group II, just over three-fifths of Group III, and less than one-half of Group IV persons made statements which were so classifiable. Comments of the interviewees who are favorable toward mechanization are worth noting. Typical statements were as follows: "I don't like mules and I get more money on the tractor," "Too much walking with mules," and "Wouldn't work any other way."

Strangely enough, there is indication that the relationship between unfavorable opinions of mechanization and Mechanization Groups is positive. In other words, even though proportionately more non-operators in Group I are favorable to mechanization, a larger percentage are also unfavorable to mechanization. Apparently the machines make enemies as well as friends. This may be particularly true of those persons who lose status or pay, relatively speaking, to heretofore equals in a system with little opportunity for specialization. The data show that 20.6 per cent of the non-operators in Group I, 19.4 per cent of those in Group II, 5.7 per cent of those in Group III, and 12.5 per cent of those in Group IV are definitely not sold on mechanization. Typical comments of the persons expressing disfavor with machines include: "It cuts out a lot of work for the laborers," "It puts too many people out of work," "Ruining farming in Louisiana," and "I'd rather work with mules." Obviously the latter two statements could involve a certain amount of rationalization. It is also true that in some quarters there is wide spread apprehension with respect to labor displacement by machines. In this connection, it was reported to the writer that a few operators actually used the threat of mechanization to keep laborers from making higher wage demands. It should also be recognized that laborers who have left the farms might, depending on whether or not they were forced off, express more unfavorable attitudes toward mechanization than the ones who are left behind.

Perhaps a more acid test of attitudes toward mechanization is whether or not the individual non-operator prefers to work on a mechanized farm. Again, however, there is some possibility that rationalizations might come into play. The variations between the percentages of non-operators in Groups I, II, and III expressing preference for work on mechanized farms are not great, ranging in the vicinity of two out of every three. In the least mechanized group, however, only one-half of the non-operators interviewed expressed such a preference. On the other hand, as many as 45.0 per cent of Group IV persons had no such preference. The percentages of Groups I, II, and III not preferring mechanized farms is 28.5, 32.8, and 31.4, respectively. No significant numbers of interviewees were undecided in any of the groups.

Apparently the important conclusions which may be drawn from the above data are twofold. The first is that many laborers are somewhat skeptical of mechanization, perhaps thinking of it as a competitor for their jobs. The second conclusion however is that once laborers find their places on mechanized farms, they prefer such work to the work found on non-mechanized units.

III. MECHANIZATION AND SOCIAL CHANGE

It was pointed out in the introductory section of this report that evidence exists which indicates mechanization has been associated with considerable social change in the state and region. In this connection, it may be observed that social disorganization results from the impact of forces producing social change. Thus it seems logical to assume that mechanization has disturbed the institutional structure of the southern region and has brought or is bringing about a cultural lag resulting in disorganization. To put it differently, it is possible to hypothesize that technological innovations in southern agriculture are accompanied by a disruption of societal units, such as social groups and social institutions. Findings with regards to this hypothesis are presented in the following section.

Before entering into a discussion of the social effects of agricultural mechanization, one should be aware that it is an impossible task to segregate the influences of one component element in the whole of a technological invasion. As has been said before, this writer, in the face of many improvements in the farm home and on the farm scene, as well as changes in rural educational and political philosophies, is hesitant to say that shifting to combustion engines and electrical power in the operation of farms is the sole or even the major factor responsible for any given changes in Louisiana argricultural systems.[8] It is certain that the social value systems of the Yeoman farmers of north Louisiana, the planters of the Mississippi Delta, and the south Louisiana Acadian farmers differ radically on some points. The use of Mechanization Groups is, of course, an attempt to hold constant the one factor of mechanization. Yet it is only being realistic to admit that in many instances other factors besides mechanization may be the most important in a given change which is observed. Where such seems the case, emphasis will be given the fact of the change rather than its relation to mechanization. However, at no time should it be assumed that one factor is posed as the sole stimulus responsible for any change which might be shown. It should also be remembered that the secondary or derivative effects of technological changes are often more important than their primary effects. Changes in social values and institutions often fall under this heading.

---

[8] Alvin L. Bertrand, "Some Social Implications of the Mechanization of Southern Agriculture," *The Southwestern Social Science Quarterly*, XXXI (1950), 121.

Socio-Economic Changes

The socio-economic consequences of mechanization are discussed first for two reasons: (1) The economic is one of the more important spheres of influence among rural people. All persons conversant with agricultural life recognize that the farmers' struggle for existence is essentially carried on within the framework of economic activity. (2) Economic institutions in the United States traditionally have not been bound by rigid rules of conduct, and therefore they respond quickly to any stimuli. In other words, new conditions readily promote changes when they disrupt the existing competitive process. Among the economic effects of agricultural mechanization in Louisiana, the following have been pointed up by the present study.

Changes in Machinery and Equipment

Mechanization means a high tractor-cropland ratio. This fact has been noted elsewhere, but since it precipitates complete farm reorganization, it needs further expansion at this point. The importance of tractors in mechanization is shown in Figure 4. In the most highly mechanized parishes (Group I) there was, in 1945, one tractor for every 160 acres of cultivated land. This is indeed a high ratio when contrasted to the one tractor for every 666 acres of cultivated land in the least mechanized parishes (Group IV).

The changes in numbers of tractors over the 15-year period from 1930 to 1945 give some indication of the growth of mechanization in the state. Of significance is the fact that Group IV shows the largest percentage increase in tractors per 1,000 acres of cropland between 1930 and 1945, although it has by far the fewest tractors in either year. Group I shows the second largest increase, Group III the third largest, and Group II the least increase. It is possible that these trends foreshadow future patterns of mechanization by parishes. At the same time however it should be remembered that the number of tractors per 1,000 cultivated acres varies consistently and significantly from Group I to Group IV and that the more highly mechanized areas are nearer the maximum degree of mechanization.

Mechanization is associated with a high truck-cropland ratio. This discovery indicates that such an index might be used to determine the extent to which mechanization has progressed. Figure 4 shows that farmers in the most highly mechanized areas of the state make considerably more use of their vehicles than those in the least mechanized areas. Farmers in Group I, for example, have 6.64 trucks for every 1,000 acres of cropland, as compared with 4.13 in Group II, 3.47 in Group III, and 3.44 in Group IV. Again, it is worth noting that the percentage increases over the 15-year period under observation are somewhat larger in the least mechanized parishes. The same explanations may be applied as in the instance of tractors. It is also of significance that the number of tractors and trucks per 1,000 cultivated acres is roughly the same in Groups I, II, and III, but that in Group IV there are almost three trucks for every tractor. Apparently, in the latter group, trucks are utilized for tasks accomplished with tractors in other more highly mechanized areas.

Mechanization means larger investments in implements and machinery per acre of cropland. This fact of course is readily deducible, but the exact magnitudes and differences are of interest. The importance of lack of capital outlay as a deterrent of mechanization testifies to this point. Group I farmers in 1945 had as much as $20.16 per cultivated acre invested in implements and machinery. This sum is in great contrast to the $6.72 which the Group IV persons had invested. Group II farmers had $13.39 and Group III farmers $10.95 invested in equipment per acre of cropland. In view of the existing difference it is not surprising that changes in dollar investment in implements and machinery per acre of cropland from 1930 to 1945 vary according to degrees of mechanization. The increases are shown in Figure 4.

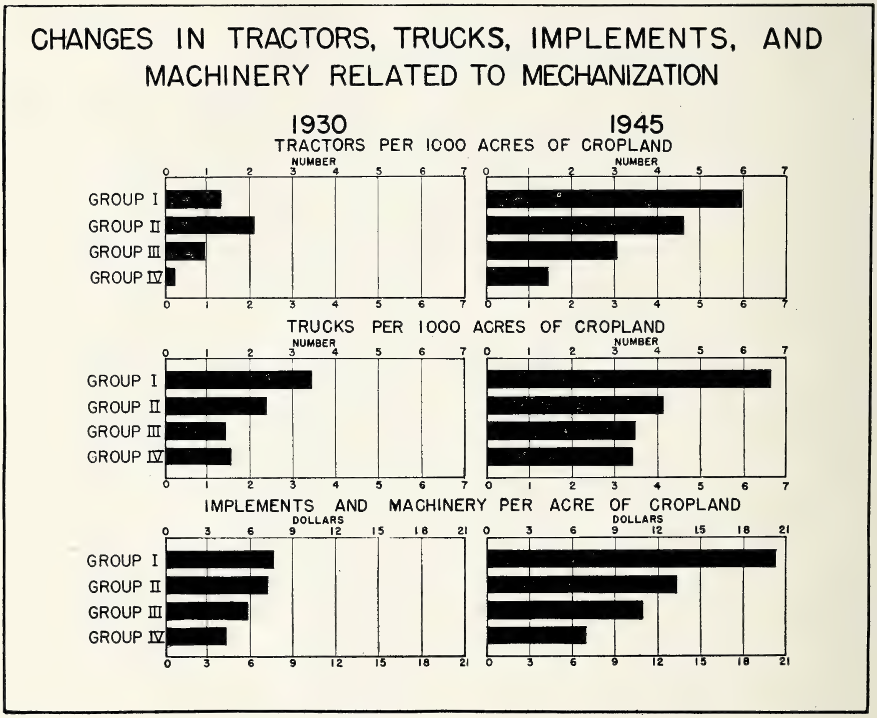


FIGURE 4. Changes in the Numbers of Tractors and Trucks and Value of Implements and Machinery Related to Cultivated Acreage, by Farm Mechanization Groups, Louisiana, 1930-1945. Source of data: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

Changes in Numbers of Mules and other Livestock

Mechanization is related to a decrease in number of mules and mule colts on farms throughout the state.[9] The relationship, however, is not as direct as might be expected. See Figure 5. The fact that the reduction in numbers of mules does not vary directly with increases in machine power is significant because it indicates other factors enter the picture. Personal interviews made at the time survey schedules were taken attested that these considerations are at least two in number. The first is that there are certain jobs which tractors cannot perform satisfactorily or at all. Thus, a certain number of draft animals must be kept on the farm even though their use is limited. The second is more subjective. Because of sentimental attachments, many farmers seem prone to "retire" rather than sell their animals after they mechanize their farms. This is significant because it points up the non-economic behavior of man, and helps shed light on certain relationships between mechanization and social change which are difficult to explain otherwise. The inevitable conclusion must be, however, that tractors reduce the need for draft animals and eventually will replace them.

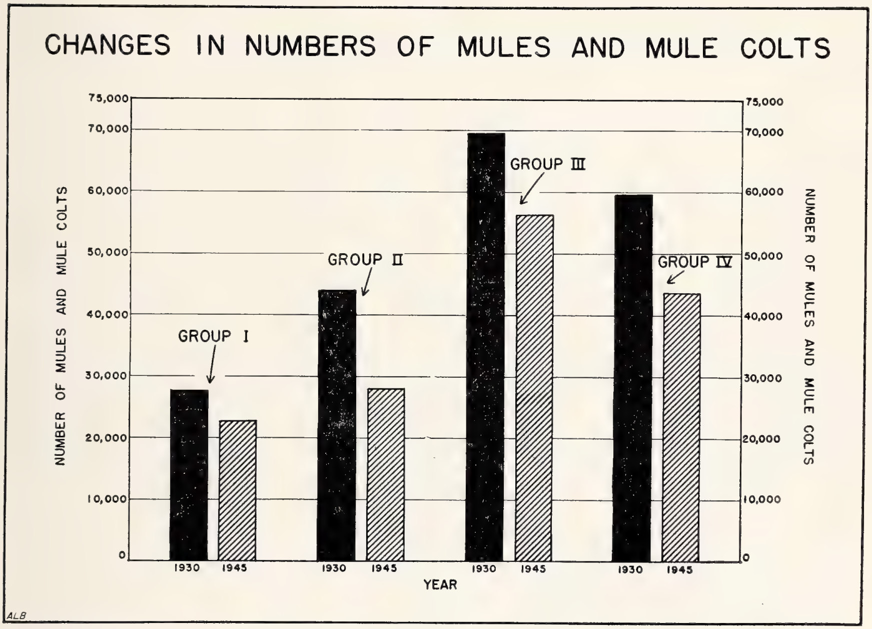


FIGURE 5. Changes in the Numbers of Mules and Mule Colts on Farms, by Mechanization Groups, Louisiana, 1930-1945. Source of data: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

---

[9] Mules were selected to represent all draft animals because horses are more likely to be used for other than draft purposes.

Farm mechanization is associated with increases in livestock other than workstock, and chickens. Two extenuating circumstances however make an exact appraisal of the effects of mechanization impossible. The first is the Census definition of "farm" which includes tracts operated by sharecroppers. These units are in reality parts of larger holdings. The second is that the period under study covers a time when farms generally were showing increases in livestock other than workstock. There are, however, obvious connecting links between mechanization and increases in livestock other than workstock. One of these is the release of considerable acreages of corn, hay, oats, and other crops for feeding of livestock accomplished through reductions in numbers of draft animals. A second link between mechanization and livestock other than workstock is the saving of labor accomplished through the use of machines.[10]

TABLE VI. CHANGES IN NUMBERS OF SELECTED LIVESTOCK AND CHICKENS, BY MECHANIZATION GROUPS, LOUISIANA, 1930-1945

Farm Mechanization Group	Average number per farm							
	All Cattle and Calves		All Hogs and Pigs		All Sheep and Lambs		Chickens	
	1930	1945	1930	1945	1930	1945	1930	1945
State	3.8	11.4	4.7	6.2	1.1	1.3	25.6	38.6
Group I	5.2	12.6	4.2	5.0	.7	.6	35.6	51.6
Group II	4.6	13.5	5.6	6.9	3.3	4.2	27.8	39.9
Group III	3.4	10.8	4.5	6.0	.5	.7	24.6	38.5
Group IV	3.3	10.0	4.4	6.3	.2	.2	21.9	32.0

Source: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

As may be seen in Table VI, the per-farm numbers of cattle, hogs, sheep, and chickens in the state increased substantially from 1930 to 1945. One interesting fact should be noted in closing the present analysis. The most highly mechanized farms have comparatively larger numbers of cattle and chickens. It may be that these two enterprises lend themselves more readily to commercialized operations such as are characteristic of mechanized units.

Changes in Tenure

Mechanization is associated with an increase in owner-operated farms. This relationship is an important one in view of the fact that tenancy is sometimes regarded as a major social ill. Perhaps the most significant discovery in this respect is the gain in owner-operated farms made by the state as a whole. Table VII shows that the number of these farms increased by one-fourth in the period under study. The fact that the smallest gain was made in Group IV indicates the role that mechanization has played in this change. The relatively small change in Group I is explained by the larger proportion of owner-operated farms in these parishes in 1930.

---

[10] This point will be substantiated in a later discussion.

TABLE VII. CHANGES IN NUMBERS OF OWNER-OPERATED FARMS IN LOUISIANA, BY MECHANIZATION GROUPS, 1930-1945

Farm Mechanization Group	Number of Owner-Operated Farms		Change	
	1930	1945	Number	Per Cent
State	46,893	58,761	11,868	+25.3
Group I	7,459	8,819	1,360	+18.2
Group II	9,941	14,005	4,064	+40.9
Group III	12,919	17,469	4,550	+35.2
Group IV	16,574	18,468	1,894	+11.4

Source: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

Mechanization is related to a readjustment in tenure groups. Although evidence of this relationship is found in the increase of owner-operators noted above, a more detailed picture appears in the tabulations shown in Table VIII. Two significant observations may be made from the data presented. The first is that all Mechanization Groups registered increases in the percentage of owners over the 15-year period from 1930 to 1945. The second is that all such groups registered decreases in tenures

TABLE VIII. CHANGES IN SELECTED TENURE GROUPS, BY MECHANIZATION GROUPS, LOUISIANA, 1930-1945

Farm Mechanization Group	Per Cent Each Tenure Group Is of All Tenures							
	Full Owners		Part-Owners		Managers		All Others	
	1930	1945	1930	1945	1930	1945	1930	1945
State	29.0	45.4	3.9	5.0	.6	.4	66.6	49.1
Group I	46.3	56.2	5.6	10.9	1.7	1.6	46.4	31.3
Group II	27.7	46.5	3.8	5.3	.7	.5	67.8	47.7
Group III	22.0	37.1	3.3	4.1	.2	.2	74.5	58.6
Group IV	32.7	50.7	4.0	3.3	.1	.2	63.2	45.8

Source: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

other than owners or managers during this time. Said another way, those persons who have been unduly concerned with the tenancy situation in the state should be heartened. From the low figure of 29.0 per cent full owners in 1930, an advance was made to the high figure of 45.4 per cent full owners in 1945. At the same time, tenure groups other than owners, part-owners, and managers dropped from 66.6 per cent to 49.1 per cent.

Another very important finding, especially from the standpoint of this study, is that mechanization is correlated with shifts to ownership and decreases in less desirable tenures. The fact that Group IV is somewhat out of line in the above associations may be partly accounted for by the mass exodus of the rural-farm population in the North Louisiana Upland Cotton parishes to accept more profitable work in the newly opened war and other industries. See Figure 7.

Another relationship evident from the data in Table VIII is that part-owners and managers are more frequently found on mechanized farms. Both of the above discoveries attest that mechanization promotes the factory system on farms, in that specialists are hired to manage the enterprises for owners. Interestingly enough, increases in numbers of part-owners vary directly with degree of mechanization. This fact no doubt indicates the first step in the expansion of holdings which takes place as mechanization moves in. (See discussion on increases in sizes of farms.)

Laborers have been affected more by mechanization than any other tenure group. This is true of both the wage laborer and the sharecropper who gets paid for his services with part of the crop. In the 10-year period from 1930 to 1940, in the state as a whole, there was a decrease of 10,857 persons among those 14 years and over reporting gainful employment in agriculture in 1940 as compared with those 10 years and over (the only near comparable figure available) reporting such employment in 1930. The correlation between Mechanization Groups and percentage losses or gains leaves no doubt of the role of mechanization in replacing or displacing agricultural laborers. In Group I, there was a drop of over one-fourth (26.1 per cent) of the number of farm wage laborers during the period under observation. A drop of 18.6 per cent was recorded in Group II. The increase of 3.9 per cent shown in Group III can be explained in terms of the large number of "new-ground" settlers arriving during this period in the parishes of West Carroll, Richland, and Franklin, which are included in this Group.[11] The number of persons gainfully employed in agriculture decreased by 4.1 per cent in Group IV. The above correlations are all the more significant because of the fact that the least mechanized parishes, which lost more heavily in general population during the period under study, experienced the lowest drop in wage laborers.

---

[11] See: John E. Mason, "Cotton Allotments in the Mississippi Delta New-Ground Area," *The Journal of Land and Public Utility Economics*, XVIII (1942), 448-457.

Empty "tenant" houses are found in south Louisiana . . .

. . . and north Louisiana.

The role of mechanization in decreasing the number of sharecroppers is also made quite clear in Table IX. In the state as a whole there was a tremendously significant drop of 24,479 sharecroppers, or approximately one-half of the total number of this group, in the 15-year period from 1930 to 1945. With the exception of Group IV, which shows a greater percentage drop than Group II and Group III, the association between Mechanization Groups and decreases in numbers of "croppers" is very close.

TABLE IX. Changes in Numbers of Farm Wage Laborers, 1930-1940, and Croppers, 1930-1945, in Louisiana, by Mechanization Groups

Farm Mechanization Group	Number of Farm Laborers				Number of Croppers			
			Change				Change	
	1930*	1940†	Number	Per Cent	1930	1945	Number	Per Cent
State	72,057	61,200	−10,857	−15.0	49,700	25,221	−24,479	−49.8
Group I	30,356	22,420	− 7,936	−26.1	16,391	7,228	− 9,163	−55.9
Group II	16,360	13,309	− 3,051	−18.6	20,856	10,982	− 9,874	−47.3
Group III	14,523	15,100	+ 577	+ 3.9	9,753	5,795	− 3,958	−40.6
Group IV	10,818	10,371	− 447	− 4.1	2,700	1,216	− 1,484	−55.0

*Persons 10 years old and over reporting gainful employment in agriculture.

†Persons 14 years old and over reporting gainful employment in agriculture.

Source: Fifteenth Census of the United States, 1930, Sixteenth Census of the United States, 1940, and United States Census of Agriculture, 1945.

The discrepancy in Group IV is accounted for in two ways. First, the opening of paper mills in north Louisiana pulled agriculturists en masse from their farms. Secondly, the number of sharecroppers in Group IV was so small to begin with that a small drop in absolute numbers meant a high percentage drop. The latter of course is not without significance.

A larger proportion of mechanized than non-mechanized farms are operated by people not living on them. This discovery is not surprising in view of the likeness of the former to factory systems. It is interesting, however, that the percentage of farms operated by non-residents has dropped slightly over the five-year period from 1940 to 1945 (for which data are available) in all Groups except Group IV, in which the percentage remained the same. See Table X. This fact in itself may be an important hint at another effect of mechanization. It could possibly mean that mechanization reduces the number of farms which are operated by non-residents. A longer test than five years will of course have to be made before definite conclusions may be reached with respect to

TABLE X. PERCENTAGE OF FARMS OPERATED BY NON-RESIDENTS, BY MECHANIZATION GROUPS, LOUISIANA, 1940-1945

Farm Mechanization Group	1940*		1945	
	Number of Farms Operated By Non-Residents	Percentage of All Farms	Number of Farms Operated By Non-Residents	Percentage of All Farms
State	6,089	4.2	4,688	3.6
Group I	994	6.5	820	5.2
Group II	1,336	4.1	955	3.2
Group III	1,932	3.7	1,410	3.1
Group IV	1,827	4.2	1,503	4.2

*Earliest data available.

Source: Sixteenth Census of the United States, 1940, and United States Census of Agriculture, 1945.

this phenomenon. The fact remains, however, that more mechanized farms are absentee owned. This suggests that they are more commercialized.

Changes in Number and Sizes of Farms

In Louisiana, the number of farms has decreased less in mechanized areas than in non-mechanized areas. All parts of the state however have undergone decreases in number of farms. In this respect, as may be seen in Figure 6, the state lost well over one-fifth of its farms in the 20-year period from 1930 to 1950.

Why mechanization should retard the trend toward fewer farms is somewhat of an enigma. The evidence shows this is true notwithstanding the inadequate Census definition of the term "farm." While Group I parishes recorded a loss of only 1.4 per cent of their farms in the period from 1930 to 1950, Group II parishes lost 19.3 per cent, Group III parishes lost 23.5 per cent, and Group IV parishes lost 32.2 per cent. The explanation may lie in the fact that the least mechanized areas represent the less desirable locations and the ones where most of the recruits for industrial jobs are obtained. In other words, the income of persons in the more highly mechanized groups is more in line with that of workers outside agriculture. Whatever the explanation, the association with mechanization is significant. It should be noted that the least mechanized areas underwent the greatest loss of population in the period under analysis, and many farms were abandoned in these parishes.

Mechanized farms are larger in size than non-mechanized farms. This is true, as may be seen in Table XI, whether total acreage or cultivated acreage is used as a measure of size. It is also true despite the unrealistic Census designation of sharecropped units as farms. For example, in 1945, Group I farms averaged 91.9 acres as compared with 89.6 acres in Group II, 63.8 acres in Group III, and 79.5 acres in Group IV. The fact that farms in Group IV are somewhat larger than farms in Group III is explained in terms of type-of-farming and topography differences in the two areas. This fact is brought out in the comparison of acreages in cultivation, the latter having more land under the plow. Harder to explain is the very small increase in size of the farms in Group I from 1930 to 1945. This is especially true since Group II, III, and IV farms registered considerable gains during this period. Hypothetically, three facts might account for the small gain in Group I. (1) There was relatively little emigration from the farming parts of this area in the period under study. (2) A relatively rigid cultural pattern of inheritance exists in French South Louisiana parishes. (3) There is a minimum of "new-ground" areas available in the parishes included.

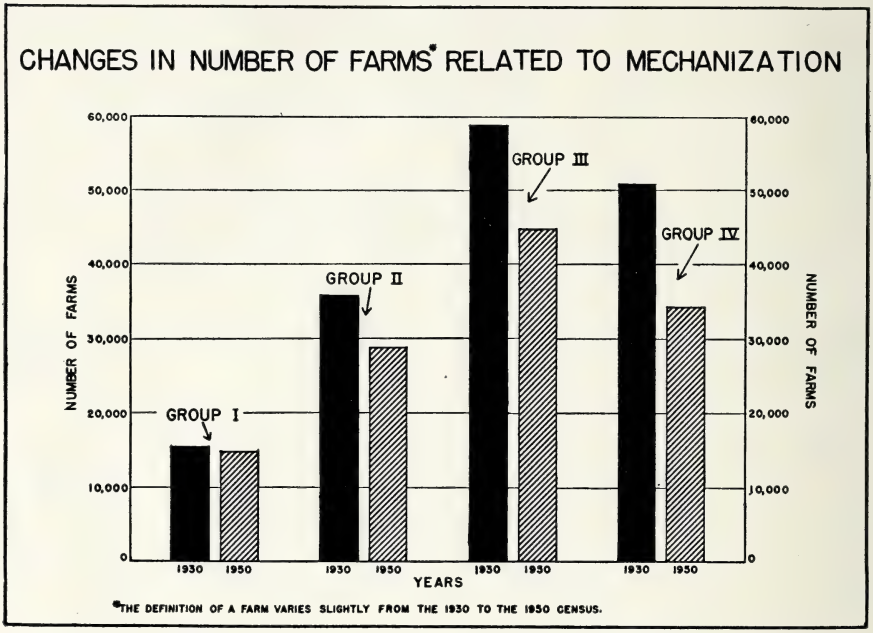


FIGURE 6. Changes in the Number of Farms by Mechanization Groups, Louisiana, 1930-1950. Source of data: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1950 Series AC 50-2, Number 72.

The average number of acres per farm in cropland varies directly with degree of mechanization. This indicates that mechanization is more closely associated with size than might be deduced from a comparison by Mechanization Groups of total land in farms. Again, it is significant that the greatest percentage increase is registered in the two intermediate groups. The same reasons for small increases in Group I probably hold for both total acreage and cultivated acreage. The average number of cropland acres and changes from 1930 to 1945 appear in Table XI.

TABLE XI. CHANGES IN TOTAL ACREAGE AND CULTIVATED ACREAGE PER FARM, BY MECHANIZATION GROUPS, LOUISIANA, 1930-1945

Farm Mechanization Group	Average Size of Farm				Average Acres of Cropland			
	1930	1945	Change		1930	1945	Change	
			Number	Per Cent			Number	Per Cent
State	62.2	77.6	11.4	17.2	29.4	40.0	10.6	36.0
Group I	90.0	91.9	1.9	2.1	39.1	44.7	5.6	14.3
Group II	64.0	89.6	25.6	39.7	31.3	43.5	12.2	38.9
Group III	43.7	63.8	20.1	45.9	26.5	38.8	12.3	46.4
Group IV	59.9	79.5	19.6	32.7	28.2	36.5	8.3	29.4

Source: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

Changes in Production and Levels of Living

The total value of farm products produced per farm is much larger on mechanized farms. Such a discovery should be expected, in view of the larger size of these farms. The differential which exists, despite Census definitions of farms, in the average total value of products produced by Group I farms and Group IV farms ($4,390 and $1,111, respectively) is, however, much greater than would be expected. The direct relationship between mechanization and value of products is

TABLE XII. CHANGES IN THE PERCENTAGE OF THE TOTAL VALUE OF FARM PRODUCTS USED BY HOUSEHOLDS, BY MECHANIZATION GROUPS, LOUISIANA, 1940-1945

Farm Mechanization Group	1940			1945		
	Total Value of Farm Products Per Farm	Value of Farm Products Used At Home Per Farm	Percentage Used At Home Per Farm	Total Value of Farm Products Per Farm	Value of Farm Products Used At Home Per Farm	Percentate Used At Home Per Farm
State	$722	$168	23.3	$1,709	$321	18.8
Group I	2,175	160	7.4	4,390	404	9.2
Group II	811	157	19.4	1,901	315	16.6
Group III	770	160	20.8	1,742	293	16.8
Group IV	533	179	33.6	1,111	350	31.5

Source: Sixteenth Census of the United States, 1940, and United States Census of Agriculture, 1945.

quite evident in Table XII. Interestingly enough, the average value of products per farm more than doubled in all groups in the short period from 1940 to 1945. It is logical to assume the general rise in prices of farm products accounts for a part of this increase. On the other hand, it may be construed that a relationship between larger farms, more intensive farming, and larger yields exists. These factors are in turn related to technological changes in farming.

The value of farm products consumed at home differs little from farm to farm, but mechanized farms consume a smaller percentage of their total products. In one sense, this discovery implies that mechanized farms are more commercialized. In other words, a larger proportion of what is produced is sold. This deduction is weakened however by the fact that there is a certain maximum consumption level per family. Thus the same amount of products consumed at home would mean a lower percentage on farms producing large amounts than on farms producing small amounts. Perhaps the more important fact, as pointed out above, is that mechanized farms produce more products per farm.

Farm mechanization and levels of living are closely related. The percentage of farm homes equipped with conveniences making for easier and more comfortable living varies consistently with the degree of farm mechanization. See Table XIII. This is significant in terms of the long time end-effect of mechanization. Thus, when the discovery is made that a larger percentage of farmers in Group I have automobiles, electricity, running water, radios, and telephones, it suggests that mechanization is helping remove existing discrepancies between rural and urban levels of living. Group II farmers rank second in ownership and use of the above named conveniences and facilities with the exception of telephones. Farmers in the lowest two Mechanization Groups have about the same consumption levels on the items used for this study. One outstanding fact shown in Table XIII is that telephones, especially, are

TABLE XIII. PERCENTAGE OF FARMS WITH SPECIFIED LEVEL OF LIVING ITEMS, BY MECHANIZATION GROUPS, LOUISIANA, 1945

Farm Mechanization Group	Percentage of Farms With:				
	Automobiles	Electricity	Running Water	Radios	Telephones
State	28.9	24.4	13.5	48.7	5.0
Group I	44.4	47.5	27.0	59.7	9.3
Group II	34.7	27.0	16.2	52.5	4.5
Group III	24.2	18.0	9.9	45.0	3.7
Group IV	23.3	20.6	10.2	45.8	5.2

Source: United States Census of Agriculture, 1945.

related to mechanization. Almost one-tenth of the farmers in Group I have telephones as compared with 4.5 per cent in Group II, 3.7 per cent in Group III, and 5.2 per cent in Group IV. Even when mitigating factors such as higher density of population are taken into account, this relationship is revealing.

Other Social Changes

As was brought out in the introduction to this section, other organizational arrangements of rural society besides the socio-economic are affected by technological changes. In these areas, however, the rules, principles, and standards which guide social activities are not as flexible as in the realm of economics, nor are they as easily detected and isolated. In other words, a change, much less its relationship with mechanization, may not be readily apparent. In some cases, relationships probably will appear later as long-time trends. The important fact however is that such changes are taking place. The following discussion, as the previous one, will proceed on the assumption that the change *per se* is just as important as its relationship or lack of relationship to mechanization.

At the present time, as has been mentioned, there are already many discernible changes in rural social institutions, rural social processes, and rural attitudes in the state and region. The problem at hand is to discover, insofar as this is possible, the number and nature of such trends. Exact measurements are of course for the most part impossible. Nevertheless, it is possible through the open-end questions technique to arrive at certain worthwhile conclusions. Therefore, where reliable statistical data are lacking, indications of trends and changes have been sought by posing specific questions to long-time residents of rural communities. The writer appreciates the fact that the use of such a method raises many questions in connection with the validity of interpretations. However, it is felt that in cases in which a relatively large proportion of respondents agrees that a certain change away from what has been considered normal is taking place, a general statement may be made.

It should be noted that operator and non-operator responses are grouped together for the purposes of the following analyses. Where available, Census data are utilized in determining the exact magnitude of changes. Mechanization Group differences are maintained at all times to facilitate detection of existing causal relationships.

Population Changes

Louisiana had large decreases in rural population but, as with changes in age and sex distributions, the effect of mechanization is questionable. The state as a whole lost over one-fourth of its rural-farm population between 1930 and 1945. Upon discovery of this trend it is logical to speculate on what will happen to the relative influence of the farm population in parish and state affairs. It is within the realm of possibility that the Farm Bloc will lose power and rural areas lose certain considerations. What relationship mechanization had to this phenomenon is, however, subject to discussion. The data in Figure 7 show percentage losses to be fairly close in all Mechanization Groups except Group IV, which underwent a somewhat greater loss than any of the others. The fact that the least mechanized parishes lost more farm people than all others might, on the face of it, suggest that mechanization had nothing to do with "pushing" persons out of rural areas. The truth of the matter is that there are mitigating circumstances. The recruiting of labor by several recently opened paper mills already mentioned plus the general attraction of war and post-war industries in near-by urban centers have more or less depopulated the surrounding rural areas. The "pull" of these forces has probably been more effective in Group IV because of low farm incomes in the relatively unproductive areas which are included. The number of rural-farm persons leaving the parishes in the other Mechanization Groups (over one-fifth in every instance) leaves no doubt however that mechanization has some relationship to the depopulation of rural areas.

Mechanization has little discernible effect upon the age distribution of the rural-farm population. Yet there is some indication in Table XIV that trends in 1940 may be starting in the direction of fewer children under five years of age and more older persons 45 years of age and over in the more mechanized parishes. As of now, these differences are not large enough to warrant generalizations. If these trends materialize,

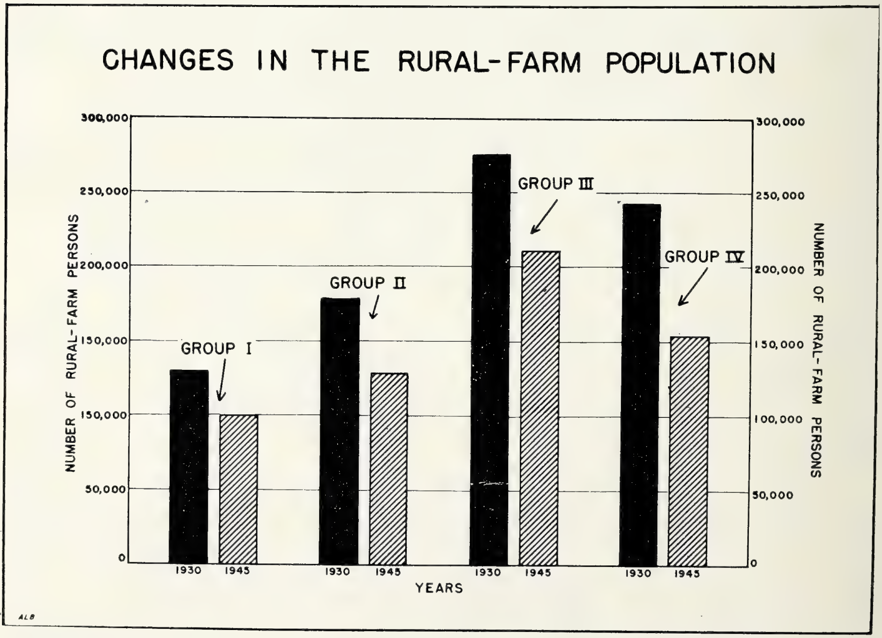


FIGURE 7. Changes in the Rural-Farm Population, by Mechanization Group, Louisiana, 1930-1945. Source of data: Fifteenth Census of the United States, 1930, and United States Census of Agriculture, 1945.

mechanization will help make the rural family more urbanlike in one sense (smaller size) and more rural-nonfarm like in another sense (more older persons). However, why mechanized areas should have larger percentages of older people in their population is not easily explained. Perhaps machines prolong the period of productivity of individuals on the one hand and lengthen life on the other.

The relationship between mechanization and changes in the sex distributions of the rural-farm population is not clear-cut. It is interesting, nonetheless, that Groups I and II registered the largest percentage increase in sex ratios from 1930 to 1940, although in inverse order. If this is the first indication of a continuing trend, it will mean that the disparity between the number of males and females in rural areas will be increased. Possible explanation of this phenomenon may be found in the fact that jobs on mechanized farms more often call for masculine specialties. There is also an additional possibility that mechanization

TABLE XIV. AGE DISTRIBUTION OF THE RURAL-FARM POPULATION, BY MECHANIZATION GROUPS, LOUISIANA, 1940

Farm Mechanization Group	Percentage Each Age Group Is of Total Population					
	Under 5 Years	5-14 Years	15-24 Years	25-44 Years	45-64 Years	65 Years And Over
State	11.9	24.2	20.4	24.4	14.4	4.7
Group I	11.6	23.1	20.9	24.4	15.0	5.0
Group II	11.3	23.5	19.8	25.4	15.0	5.0
Group III	12.5	24.8	20.3	24.5	13.7	4.2
Group IV	11.8	24.5	20.6	23.7	14.5	4.9

Source: Sixteenth Census of the United States, 1940.

TABLE XV. CHANGES IN SEX DISTRIBUTION OF THE RURAL-FARM POPULATION, BY MECHANIZATION GROUPS, LOUISIANA, 1930-1940

Farm Mechanization Group	Sex Distribution of Population				Sex Ratios		
	1930		1940				
	Females	Males	Females	Males	1930	1940	Per Cent Change
State	403,070	423,811	410,677	439,705	105.1	107.1	2.0
Group I	63,711	67,549	67,343	72,757	106.0	108.0	2.0
Group II	86,011	91,065	87,322	95,985	105.9	109.9	4.0
Group III	134,321	141,152	139,229	147,479	105.1	105.9	.8
Group IV	118,991	124,045	116,783	123,484	104.2	105.7	1.5

Source: Fifteenth Census of the United States, 1930, and Sixteenth Census of the United States, 1940.

detracts from the advantage of family groups as "hoe hands" and "pickers" and makes more places for single men on farms. Such an occurrence would, in theory, precipitate changes in housing, recreation, and other social phenomena.

Changes in Social Institutions

Rural people are convinced that their schools are better equipped, more adequately staffed, and better attended than a few years back. Traditionally, rural children have been handicapped in their efforts to obtain formal education. This has been especially true in the South, as casual review of the statistics on length of term, attendance, teachers' training, teachers' pay, and school facilities dramatically portray. It is therefore always encouraging for residents of the region to note trends toward the equalization of educational opportunities of rural and urban children. Such is indicated by the responses of rural male adults to questions dealing with changes in the schools.

In the first place, rural people throughout the state are satisfied that the schools their children attend have more and better equipment and more highly trained teachers than a few years back. As many as 93.8 per cent of all persons interviewed agreed on this point. No doubt the recent state legislative action increasing the salaries of teachers has been of importance in the above change.

Attitudes of rural people have not always been favorable toward public schools. Some of them have tended, in the past, to feel that experience is the best teacher and consequently that farm work should take precedence over school attendance. At the same time, many farmers have expressed the attitude that schools educated their children away from the farm and farm life. Indication that these attitudes are changing and that parents are more interested in sending farm youngsters to school is found in the large percentage of respondents (85.7 per cent) who noted better attendance of children in school.

Over one-half of the persons interviewed (54.4 per cent) pointed out a trend for small rural schools to be closed and rural children sent to schools located in town. This of course is in line with the movement to consolidate school systems which has been underway for some time. Interestingly enough, however, a rather large percentage of the rural population interviewed (45.6 per cent) would not concede this to be true. It is possible that this trend is more prevalent in some areas than in others. On the other hand, it may be that rural people are slow to acknowledge an obvious gain to village and town people.

Despite the evidence that rural schools are turning toward town locations, rural parents report taking more active part in school activities. Eighty-five per cent of the persons interviewed said rural people were more active in this way. By taking part in school activities rural parents are increasing their social contacts which in turn should tend to make them more community conscious and less individualistic.

On the face of the generalness of opinions expressed, mechanization

TABLE XVI. INTERVIEWEE OPINION WITH REGARD TO CERTAIN CHANGES IN RURAL SOCIAL INSTITUTIONS AND PROCESSES IN THE LAST 15 YEARS, BY MECHANIZATION GROUPS, LOUISIANA, 1950

Statement of Information or Opinion	Interviewees Reporting*																			
	Group I				Group II				Group III				Group IV				Total Sample			
	Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.	%	No.	%
Schools moving to town	58	51.0	56	49.0	60	50.4	59	49.6	48	61.4	29	38.6	69	57.5	53	42.5	235	54.4	197	45.6
Schools better equipped and staffed	104	93.7	7	6.3	111	92.5	9	7.5	110	94.8	6	5.2	112	94.1	7	5.9	437	93.8	29	6.2
School attendance higher	90	78.9	24	21.1	107	90.0	102	10.0	102	88.0	14	12.0	101	85.6	17	14.4	400	85.7	67	14.3
More adult participation in school activities	95	85.5	16	14.5	92	82.1	20	17.9	102	92.7	8	7.3	91	79.8	23	20.2	380	85.0	67	15.0
Families as large	68	59.6	46	40.4	75	62.5	45	37.5	54	47.8	59	52.2	46	38.0	75	62.0	243	52.0	225	48.0
People marry as early	103	88.0	14	12.0	94	79.0	25	21.0	101	88.6	13	11.4	51	42.5	69	57.5	349	74.3	121	25.7
As many church and home weddings	99	88.4	13	11.6	68	81.9	15	18.1	115	75.7	37	24.3	76	66.1	39	33.9	358	77.5	104	22.5
More divorces	41	35.7	74	64.3	42	34.4	80	65.6	36	32.1	76	67.9	39	33.0	79	67.0	158	33.9	309	66.1
Children respect parents as much	32	28.6	80	71.4	27	21.4	99	78.6	31	28.0	80	72.0	23	19.0	98	81.0	113	24.0	357	76.0
Families stick together as well	52	45.2	63	54.8	36	29.3	87	70.7	52	46.4	60	53.6	28	23.5	91	76.5	168	35.8	301	64.2
As many churches	110	94.0	7	6.0	98	79.7	25	20.3	99	86.0	16	14.0	106	86.9	16	13.1	413	86.6	64	13.4
Increased church attendance	45	72.6	17	27.4	41	58.6	29	41.4	31	88.6	4	11.4	19	47.5	21	52.5	136	65.7	71	34.3
Churches moving to town	18	15.4	99	84.6	42	28.2	107	71.8	60	70.6	25	29.4	16	13.0	107	87.0	136	28.7	338	71.3
Church services improved	61	96.8	2	3.2	102	85.7	17	14.3	112	98.2	2	1.8	33	84.6	6	15.4	308	91.9	27	8.1
As much mutual aid	78	68.4	36	31.6	54	43.9	69	56.1	77	67.5	37	32.5	43	36.1	76	63.9	252	53.6	218	46.4
As much visiting	74	64.9	40	35.1	60	49.2	62	50.8	88	75.9	28	24.1	57	46.3	66	53.7	279	58.7	196	41.3
More formal cooperatives	38	40.4	56	59.6	23	21.3	85	78.7	48	44.8	59	55.2	4	3.4	113	96.6	113	26.5	313	73.5
Incomes higher	75	66.9	37	33.1	81	68.0	38	31.9	98	84.4	18	15.4	103	84.4	19	15.5	357	76.1	112	23.9
Levels of living higher	90	72.0	35	28.0	96	79.3	25	20.7	108	94.7	6	5.2	119	96.7	4	3.2	413	85.5	70	14.5
People healthier	64	66.7	32	33.3	80	66.7	40	33.3	105	94.6	6	5.4	86	71.7	34	28.3	335	74.9	112	25.1
People happier	89	78.1	25	21.9	87	77.7	25	22.3	86	81.1	20	18.9	101	84.2	19	15.8	363	80.3	89	19.7

TABLE XVI. (CONT'D). INTERVIEWEE OPINION WITH REGARD TO CERTAIN CHANGES IN RURAL SOCIAL INSTITUTIONS AND PROCESSES IN THE LAST 15 YEARS, BY MECHANIZATION GROUPS, LOUISIANA, 1950

Statement of Information	Interviewees Reporting*																			
	Group I				Group II				Group III				Group IV				Total Sample			
	Yes		No		Yes		No		Yes		No		Yes		No		Yes		No	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.	%	No.	%
More leisure time	81	69.8	35	30.2	31	38.3	50	61.7	64	56.7	49	43.3	63	54.3	53	45.7	239	56.1	187	43.9
More work	43	38.4	69	61.6	33	32.0	70	68.0	19	31.1	42	68.9	13	32.5	27	67.5	108	34.2	208	65.8
More radio listening	110	93.2	8	6.8	108	95.5	5	4.4	124	99.2	1	.8	122	97.6	3	2.4	464	96.5	17	3.5
Movie attendance higher	97	83.6	19	16.4	115	94.3	7	5.7	106	92.1	9	7.8	115	93.5	8	6.5	433	91.0	43	9.0
Social participation increased	91	77.1	27	22.9	90	75.6	29	24.4	102	89.5	12	10.5	93	81.6	21	18.4	376	80.9	89	19.1
Rural-urban relations improved	98	83.6	16	16.4	109	90.1	12	9.9	103	94.5	6	5.5	119	97.5	3	2.5	429	92.1	37	7.9
Rural people more urban-like	87	77.0	26	23.0	87	77.7	25	22.3	86	81.1	20	18.9	101	84.2	19	15.8	361	80.0	90	20.0

*Incomplete schedules account for slight total differences from question to question does not seem to be directly related to any of the above changes. The relationship between the percentage of rural-farm persons 25 years of age and over having completed high school and Mechanization Groups, however, shows otherwise. Except for Group IV, which has the highest percentage of all, the association between these two variables is direct. Those acquainted with the exceptionally high value placed on education by the Yeoman-type farmers of north Louisiana explain the high percentage in Group IV on that basis.

TABLE XVII. PERCENTAGE OF RURAL-FARM POPULATION 25 YEARS OLD AND OVER HAVING COMPLETED HIGH SCHOOL, BY MECHANIZATION GROUPS, LOUISIANA, 1940

Farm Mechanization Group	Total Number of Persons 25 Years of Age and Over	Number of Persons 25 Years of Age and Over Completing High School	Per Cent of Persons 25 Years of Age and Over Completing High School
Louisiana	370,605	13,592	3.6
Group I	62,184	2,400	3.9
Group II	83,162	3,098	3.7
Group III	121,624	3,584	2.9
Group IV	103,635	4,510	4.4

Source Sixteenth Census of the United States, 1940.

There is evidence in support of the hypothesis that social bonds holding the rural family together are weakening. The family is the basic unit in the structure of society. It is pertinent therefore to inquire as to the changes taking place in the southern rural family and to the role of mechanization or technology in effecting these changes. Such an investigation is especially important because the rural areas of the southern region have long served as the "seedbed of the nation." If this "seedbed" should cease to yield, for any reason whatsoever, the nation would stand to lose much of its virility.

It has already been pointed out that Census statistics on age distribution hint at smaller families in rural areas. This and several other questions having to do with changes in family patterns were put to all interviewees. Their opinions appear in Table XVI. The most notable change taking place in the rural-farm family, according to answers of the informants, is that it is less closely knit, or, as put in their language, the family members do not stick together as well. Further evidence that this is true is found in the responses to the companion question, "Do children respect their parents as much?" In this instance, over three-fourths of the answers were in the negative. A third question bearing on this phenomenon lends support, but to a lesser degree, to the general proposition. One-third of the persons who were interviewed stated that there were at present more divorces among rural people.

A good indication that rural families are getting smaller is found in the 48.0 per cent of the respondents' answers so stating. It is not possible at present to determine how fully mechanization enters this particular picture. The fertility ratios of the rural-farm population of the various Mechanization Groups in 1940 suggest a relationship, however. Although Group I has a slightly higher ratio than Group II, this may be explained in terms of the high proportion of Catholics in the former Group. The explanation of why Group IV should have a lower ratio than Group III is harder to find. It lies, perhaps, in differences in social value systems. See Table XVIII. The role of mechanization in all changes listed above is apparently of a secondary or derivative nature.

TABLE XVIII. Fertility Ratio of Rural-Farm Population, by Mechanization Groups, Louisiana, 1940

Farm Mechanization Group	Number of Children 0-5 Years of Age	Females 15-44 Years of Age	Fertility Ratio
Louisiana	101,118	185,167	546.0
Group I	16,279	30,580	532.3
Group II	20,669	39,603	521.9
Group III	35,718	62,869	568.1
Group IV	28,452	52,115	545.9

Source: Sixteenth Census of the United States, 1940.

The number of rural churches is thought to have decreased during the last few years by informants but they believe attendance of the remaining churches is improving. The latter is accounted for to some extent by more highly educated and trained church officials in the country churches. Another factor is the vigorous efforts by certain denominational groups to rejuvenate their rural constituency. The opinions of interviewees, as may be seen in Table XVI, indicate the trends described above.

Since religion has been one of the major social forces in the rural South, the above findings have great significance. If, for example, the rural church loses its strength, one of the chief bonds holding the rural community together will be removed.

Interestingly enough, while the relationship is by no means direct, there is reason to suspect some influence by mechanization. Group I, located as it is in a Catholic region, would not be expected to show as close an association in this respect as the areas where churches are maintained by individual congregations and more readily subject to change. With this exception, the more mechanized parishes, according to informants, are characterized by fewer churches and decreased attendance. Such a relationship is of course understandable in the light of the greater decreases of population in mechanized areas.

Changes in Social Participation, Health, and Happiness

Farmers' opinions indicate rural people are moving away from mutual aid and neighborly practices toward formal cooperative arrangements. In response to the question "Do farmers help each other out as much as they did?" 46.4 per cent of the interviewees said "No." Close to the same percentage (41.2) were of the opinion that there was less visiting among neighbors. On the other hand, over one-fourth (26.5 per cent) reported more experience with formal-type cooperatives. This suggests that farmers in the future will carry on their activities in a less personalized atmosphere.

No direct relationship between mechanization and the above responses appear, yet some association no doubt exists. Apparently other factors, including differences in cultural background, weigh more heavily in accounting for or delaying trends of the above nature in certain areas.

Rural people generally have as much or more money, enjoy higher levels of living, are healthier, and are happier than they were 15 years ago. Perhaps such discoveries do not seem profound in view of the changes in the economic picture which have generally taken place. It should be remembered however that farmers have not always been receptive to changes and that income is not necessarily correlated with happiness. Levels of living and health are of course closely tied together, and it is encouraging to note that rural people consider themselves better off in both at present.

There is no consistent pattern of relationship between Mechanization Groups and opinions on the above matters. Seemingly, however, there is a tendency for the least mechanized groups to be more aware of changes for the better. This is surprising in view of the correlation between mechanization and level of living as shown previously. Perhaps these persons were so far down the socio-economic scale in the past that moderate changes make more of an impression on them than on persons who were accustomed to higher levels of living. The exact percentages of persons expressing positive and negative opinions on each of the above items may be seen in Table XVI.

Despite the lack of correlation of above opinions to mechanization, there is unmistakable evidence of such a relationship. Figure 8, showing the number of persons per doctor by Mechanization Groups in 1950, gives proof that the most highly mechanized regions have decided advantages in terms of medical care.

Mechanization, according to the reports of a significant percentage of workers on mechanized farms, has reduced the work of farmers and given them more leisure time. Although the proportion of respondents admitting these changes differed rather widely from Mechanization Group to Mechanization Group, over one-half of the total number expressed such opinions. In fact, as many as two-thirds of the interviewees stated that they were not working as hard.

The implications of shorter hours and more leisure time for farmers are many. In the first place it is another indication that agricultural systems are becoming more like factory systems. Secondly, it provides an opportunity for rural people to become more concerned with off-farm leisure-time activities. A third possibility is that it will tend to make farm work more attractive to many persons not formerly interested in this occupation. All in all, farm communities will probably move more and more in the direction of secondary groups for recreation.

The vast majority of interviewees agreed that rural people participate more in social and recreational activities at the present time. Such might be suspected in view of the greater amount of leisure and higher incomes of farmers. As may be seen in Table XVI, the types of activities which show an increased participation include radio listening, movie attendance, social gatherings of all kinds, and school programs. The latter has already been discussed under a previous heading.

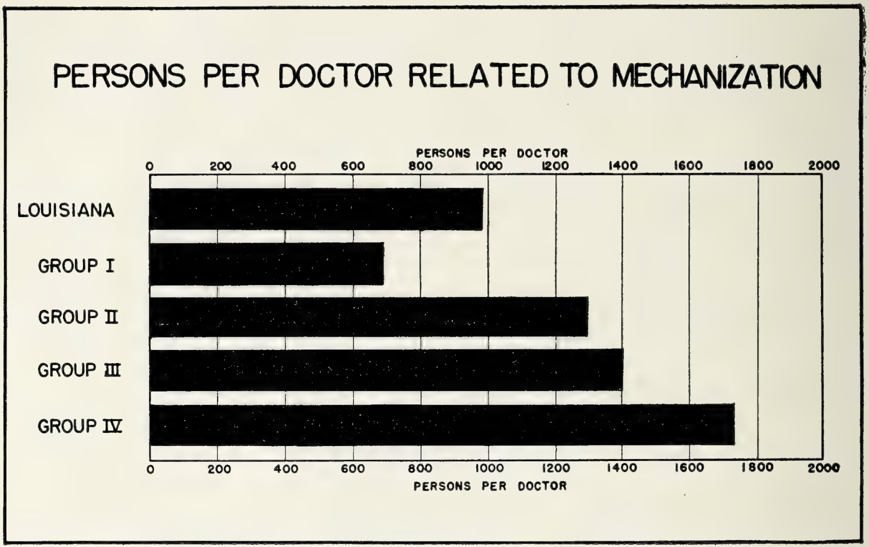


FIGURE 8. Persons Per Doctor, by Mechanization Groups, Louisiana, 1950. Source of data: 1950 Census of Population, Preliminary Count, Series PC-3, Number 4, and Paul H. Price and Homer L. Hitt, *The Availability of Medical Personnel in Rural Louisiana,* Baton Rouge: Louisiana Agricultural Experiment Station Bulletin No. 459, 1951.

Somewhat surprising is the inverse relationship between mechanization and increased participation in the above activities. Why the farmers in the least mechanized group should be more convinced that the above is true is subject to speculation. The most plausible explanation seems to be the one used in connection with similar inter-relationships in previous analyses. Perhaps persons who have been at an extremely low level of participation are more impressed with changes which approach the nature of "kind," whereas persons in areas where more participation has been prevalent note only a change in "degree."

It is possible however to speculate on the end results of more social participation by rural people. First, an assumption of functions once performed by the family by other social institutions is indicated. Such an eventuality, in conjunction with certain trends already pointed out, suggests a movement away from primary to secondary relationships in rural areas. This is a change away from the traditional mechanistic solidarity based on homogeneity of rural society towards an organic type solidarity based on specialization and division of labor. The latter type cohesion is, as Smith points out, more characteristic of urban societies.[12]

Changes in Town-Country Relations

The understanding between farmers and town people is improving as rural people are becoming more urban-like in their ways of living, attitudes, and philosophies. Four out of every five persons who were interviewed expressed opinions alluding to changes of the above nature. Mechanization Group variations are slight but indicate an inverse relationship between mechanization and opinion. Again the explanation heretofore used to explain like associations seems to apply. In fact, the consistency with which the least mechanized groups tend to be more aware of certain changes may be construed as proof of the validity of this explanation.

The significance of a narrowing of the differences between rural and urban populations is great. Many interesting developments may be envisioned. For example, it is probable that changes will be forthcoming in political alignments, consumption habits, ideologies, traditions, and values. If such changes occur, they will, in turn, outdate present understandings of group behavior and characteristics in rural areas.

IV. CONCLUSIONS

The salient findings of the above report may be stated in succinct form as follows. Agricultural mechanization stimulated by the economic motive is proceeding at a rapid rate in Louisiana. It has been responsible to a greater or lesser degree for many changes on the farm and in farm people. Together with other technological advances and changes in ideologies and philosophies it has worked and is working to reduce the differences between the two heretofore quite distinct residential segments of the population—the rural and the urban. The fact that much social change is taking place in farm areas emphasizes that rural society is dynamic and not static in nature—that characteristics which describe it today may not hold tomorrow. There is both a warning and an opportunity for Rural Sociologists in the above knowledge. They must ever be on the alert to detect and call attention to changes in rural life. At the same time their work will never be done or become uninteresting.

---

[12] T. Lynn Smith, *Sociology of Rural Life,* Rev. Ed., New York: Harper and Brothers, 1947, pp. 37-38.

V. SUMMARY

1. All farm areas of the State of Louisiana have been characterized by substantial gains in agricultural mechanization during the last 20 years. The most highly mechanized region of the state centers in what is commonly known as the Sugar parishes of south Louisiana. The next highest mechanized parishes are somewhat scattered. Included in this group are the inner tier of the upper Mississippi Delta parishes, the lower tier of the so-called Florida parishes in southeast Louisiana, and several southwest Louisiana rice-growing parishes. The third highest group of parishes, according to degree of mechanization, includes the remaining rice-growing parishes of southwest Louisiana, several adjacent mixed-farming parishes, three upper Red River Delta parishes, and four outer Mississippi Delta parishes. Parishes with the least concentration of mechanization, except for three upper Florida parishes and one south central parish, are all found in the north and central Hill and Cut-over areas.

2. Although the depression, AAA program, and World War II are given credit for setting in motion processes which precipitated agricultural mechanization in the southern region, individual farmers over the state name economy, labor shortage, and efficiency, in that order, as the most important reasons why they have mechanized. A lack of necessary finances has deterred farmers who have not mechanized but who intend to do so, while age, lack of finances, and lack of land have discouraged operators who are not mechanized and who do not plan to mechanize. Non-operators have mixed emotions about mechanization. However, those on mechanized farms are favorably inclined toward machines.

3. In Louisiana, the mechanization of farms has been directly associated with a steady advance in the number of tractors, trucks, implements, and machinery; a decrease in draft animals; an increase in livestock other than workstock; an increase in owner-operated farms; a decrease in numbers of sharecroppers and laborers; absentee ownership; a decrease in the number of farms; an increase in the size of farms; an increase in total value of farm products produced; and a higher level of living.

4. Social changes taking place in rural areas of Louisiana, which are more or less associated with agricultural mechanization, include decreases in rural population; improvements in the equipment, faculty, and attendance of rural schools; a loosening of the ties on individual members of the rural family; a loss of many of the rural family's functions to other social institutions; a decline in the influence of the rural church; a decrease in mutual aid practices; an increase in leisure time; an increase in social participation; and improved town-country relations.

5. In the final analysis, it may be pointed out that there is an increasing commercialization of farming and an increasing urbanization of rural populations in Louisiana. Both of these trends are in large measure due to the mechanization of agricultural systems.

.E3 D

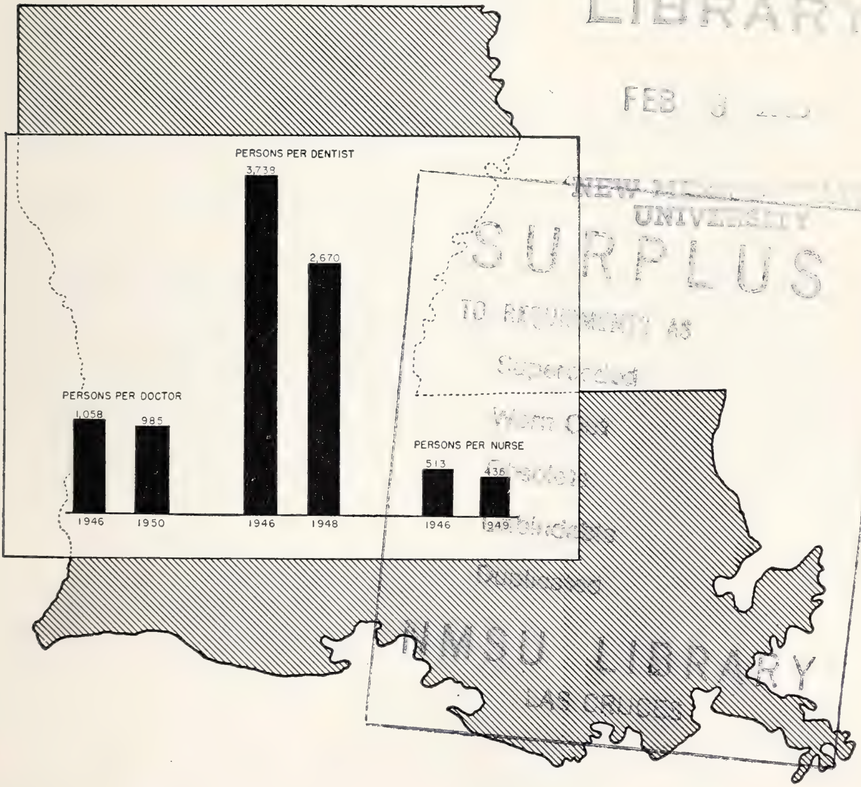
LOUISIANA BULLETIN NO. 459 JUNE, 1951

THE AVAILABILITY OF MEDICAL PERSONNEL IN RURAL LOUISIANA

By

PAUL H. PRICE AND HOMER L. HITT

LIBRARY
FEB
NEW MEXICO STATE UNIVERSITY
SURPLUS
TO RECIPIENTS AS
Superseded
Worn Out
Obsolete
Duplicate
NMSU LIBRARY
LAS CRUCES



LOUISIANA STATE UNIVERSITY
AND
AGRICULTURAL AND MECHANICAL COLLEGE

AGRICULTURAL EXPERIMENT STATION
W. G. TAGGART, Director

TABLE OF CONTENTS

Methodology 3
Louisiana in the National Scene 4
The Availability of Doctors 5
The Availability of Dentists 9
The Availability of Registered Nurses 13
Trends 17
Summary and Conclusions 19

List of Tables

I. Number of Doctors and Persons per Doctor, by Parishes, 1946 and 1950 6
II. Number of Dentists and Persons per Dentist, by Parishes, 1946 and 1948 11
III. Number of Registered Nurses and Persons per Registered Nurse, by Parishes, 1946 and 1949 16
IV. Changes in Persons-Per-Doctor, -Per-Dentist, and -Per-Registered Nurse Ratios, Classified According to the Degree of Urbanity of the Parishes, 1946 and 1950 18

List of Figures

1. The Distribution of Doctors, 1950 9
2. The Distribution of Dentists, 1948 13
3. The Distribution of Registered Nurses, 1949 15

Franklin Press, Inc., Baton Rouge, La.

The Availability of Medical Personnel in Rural Louisiana

PAUL H. PRICE AND HOMER L. HITT

Department of Rural Sociology
Louisiana Agricultural Experiment Station

It has long been recognized that rural people are at a relative disadvantage from the standpoint of the availability of medical personnel. The awareness of this differential was accentuated by the conditions arising out of World War II. In some rural areas, the entry of such personnel into the armed services left the people completely without professional medical care. The termination of the war with the subsequent return of many doctors, dentists, and nurses to civilian life has undoubtedly alleviated the shortages in some sections. The objectives of this study, therefore, are to determine the present status of the supply of medical personnel in rural areas and to ascertain the nature of trends which have developed since 1946.

Methodology

The basic indexes of availability used in this analysis are persons-per-doctor, -per-dentist, and -per-nurse ratios, which relate the number of persons in a population to the number of medical personnel present to serve them. These ratios are expressed as the average number of persons to each doctor, dentist or nurse. Since data are available only for political divisions (parishes and states), the ratios must necessarily be calculated for these areas. This fact places a limitation on the use of such ratios as bases for broad generalizations, since persons and medical personnel do not respect political boundaries. Because of this circumstance, a parish with extremely high persons-per-doctor, -per-dentist, and -per-nurse ratios which is adjacent to a parish with very low ratios may, in reality, be in a more favorable position than a parish with lower ratios which is not adjacent to such a parish. However, population-medical personnel ratios do serve to clarify existing situations insofar as the numerical adequacy of doctors, dentists, and nurses is concerned.[1]

In order to minimize the limitations in the use of population-medical personnel ratios, the data have been presented in graphic form (Figures 1, 2, and 3). These maps have been drawn to scale, and they indicate the distances from localities having a doctor, dentist, and nurse without the bias introduced by the presence of parish lines. The only restriction in the use of this technique is that some of the people living adjacent to the boundaries of Louisiana are serviced by medical personnel in Arkansas, Texas, and Mississippi. In general, however, this technique gives an accurate picture of the spatial availability of medical personnel within Louisiana.

---

[1] The populations for intercensal years have been estimated by linear interpolation.

The authors also recognize that the mere physical presence of medical personnel in an area does not mean that their services are equally accessible to everyone in that locality. This is true because medical service is not a free commodity like the air, but is, to a considerable extent, restricted to those individuals who possess the economic ability to purchase it. Medical care, of course, is made available within limits to those persons who are unable to pay for it. This study, however, is confined to analyses of the spatial distribution and the numerical adequacy of medical personnel within the state.

In basing this analysis primarily upon the ratios of the population to medical personnel, the writers neither endorse the idea nor imply that a full understanding of the adequacy of medical care can be gained from them. This approach entirely ignores the crucial factor of the varying professional competence of medical personnel (which, incidentally, presents almost insurmountable obstacles to analysis). Similarly, these ratios of population to medical personnel also disregard the type of hospital facilities and specialized equipment at the disposal of professionals which greatly influences the quality and amount of services which may be rendered. This approach, moreover, does not take account of the rapidly increasing efficiency of physicians and their co-workers through the development of the antibiotics and other remarkable drugs. Nevertheless, the ratios of potential patients to each doctor, dentist, and nurse remain highly significant and meaningful data with respect to the adequacy of medical care.

Louisiana in the National Scene

The position of Louisiana in relation to the other states of the nation in regard to medical personnel is not enviable. Data from the 1940 Census show that the state fell far below national averages, when ranked according to the number of persons for each doctor, dentist, and nurse. The national average for persons per doctor was 800; for persons per dentist, 1,878; and for persons per nurse, 370. Comparable figures for Louisiana were 1,009; 3,004; and 553. Among the 48 states, Louisiana ranked 31st in the number of persons per doctor, 35th in the number of persons per dentist, and 37th in the number of persons per nurse. These figures serve the purpose of showing that, in 1940, Louisiana still had much progress to make before the people of the state would have access to medical personnel with the same facility as the average American. The figures presented above are for the total population. If such data were available by residence, they would probably show rural Louisianians generally to be at an even greater disadvantage but the residents of some urban parishes to fare better than the national average. A further examination of census data indicates that, in general, the more urban states of the North and West have considerably lower ratios of persons per doctor, dentist, and nurse than the more rural states of the South and Southwest.

The Availability of Doctors

In 1950, there were 2,709 doctors in the state who were certified by the Louisiana State Board of Medical Examiners.[2] The ratio of persons per doctor was 985, which indicated a slight improvement over the 1946 ratio of 1,058 persons. The relative increase in the number of doctors has been slightly greater than the increase in the population of the state. Table I presents data on the number and distribution of doctors in 1946 and in 1950. These figures indicate that Louisiana is still somewhat above the 1940 ratio of persons per doctor for the nation, 985 as compared to 800, respectively. If the general standard for adequate physician supply of 1 to 1,000 as proposed by the United States Public Health Service is accepted, the state, as a whole, has a sufficient number of doctors.[3] On the other hand, the Committee on the Cost of Medical Care estimated that one practicing physician is required for every 742 persons.[4] According to this estimate, both the state and the nation have considerable progress to make before an adequate supply of doctors is available to their respective populations.

Although the over-all picture of the availability of doctors in Louisiana in 1950 does not appear too unfavorable, an analysis by parishes reveals extreme differentials. Some parts of the state have relatively few persons per doctor, while other areas are characterized by very high ratios. Parishes in which low ratios of persons per doctor prevailed in 1950 were Orleans (432), Caddo (722), East Baton Rouge (855), Rapides (920), and Ouachita (940). Only these parishes met the general standard for adequate physician supply of 1 to each 1,000 people as established by the United States Public Health Service. All of these parishes contain urban centers of substantial size.

The rural parishes, in general, have extremely high ratios of persons per doctor. If considered collectively, the 23 parishes that were totally rural in 1940,[5] i.e., with no incorporated population center with as

---

[2] It should be recognized that, although all doctors listed as certified were used in computing ratios, a considerable number of them, because of age and other circumstances, do not practice on a full-time basis. As a result, the ratios are bound to be inflated to some extent. The same is true for the data on dentists and nurses.

[3] U.S. Public Health Service, Division of Public Health Methods, *Standards of Adequacy in the Supply of Medical and Public Health Personnel Facilities,* Washington, 1942, processed. See Frederick D. Mott and Milton I. Roemer, *Rural Health and Medical Care,* (New York: McGraw Hill Book Co., Inc., 1948), p. 155.

[4] R. I. Lee and L. W. Jones, *The Fundamentals of Good Medical Care* (Committee on the Cost of Medical Care Publication No. 22, Chicago: University of Chicago Press, 1933).

[5] Assumption, Bienville, Caldwell, Cameron, Catahoula, Grant, La Salle, Livingston, Plaquemines, Pointe Coupee, Red River, Richland, Sabine, St. Bernard, St. Charles, St. Helena, St. James, St. John the Baptist, Tensas, Union, West Baton Rouge, West Carroll, West Feliciana.

TABLE I.—NUMBER OF DOCTORS AND PERSONS PER DOCTOR, BY PARISHES, 1946 AND 1950.

Parish	1946			1950		
	No. of Doctors	Persons per Doctor		No of Doctors	Persons per Doctor	
		Ratio	Rank		Ratio	Rank
Acadia	34	1,375	10	30	1,567	13
Allen	10	1,827	22	12	1,563	12
Ascension	13	1,680	17	13	1,718	17
Assumption	8	2,220	32	6	2,874	47
Avoyelles	17	2,262	34	18	2,106	31*
Beauregard	7	2,367	38	7	2,530	42
Bienville	8	2,628	44	10	1,909	26*
Bossier	11	3,222	54	10	3,696	56
Caddo	225	733	2	242	722	2
Calcasieu	58	1,315	7	74	1,209	8
Caldwell	6	1,824	21	5	2,042	28
Cameron	3	2,207	31	3	2,078	29
Catahoula	3	4,297	58	2	5,869	61
Claiborne	13	2,075	28	17	1,474	11
Concordia	7	2,062	27	6	2,391	39
De Soto	9	3,052	52	11	2,234	35
E. Baton Rouge	144	898	3	183	855	3
E.Carroll	7	2,484	40	4	4,074	58
E. Feliciana	13	1,436	13	13	1,468	10
Evangeline	7	4,477	60	10	3,190	52
Franklin	15	2,038	26	16	1,839	21
Grant	3	4,968	63	4	3,555	55
Iberia	22	1,775	18	23	1,751	18
Iberville	19	1,425	12	14	1,903	24
Jackson	10	1,637	16	9	1,713	16
Jefferson	18	4,544	59	34	3,020	49
Jefferson Davis	13	1,961	25	15	1,757	19
Lafayette	39	1,327	9	49	1,162	7
Lafourche	21	1,927	24	22	1,896	23
La Salle	12	1,000	4	11	1,154	6
Lincoln	19	1,325	8	16	1,589	14
Livingston	5	3,799	57	7	2,828	45
Madison	8	2,231	33	8	2,181	33
Morehouse	13	2,328	37	16	2,004	27
Natchitoches	18	2,169	30	18	2,097	30
Orleans	1,146	470	1	1,312	432	1
Ouachita	64	1,066	6	79	940	5
Plaquemines	5	2,692	46	6	2,371	38
Pointe Coupee	8	2,837	49	7	3,117	51
Rapides	81	1,030	5	98	920	4
Red River	6	2,268	35	5	2,418	41
Richland	13	2,117	29	14	1,904	25
Sabine	9	2,438	39	9	2,315	37
St. Bernard	2	4,783	62	1	11,089	62
St. Charles	5	2,581	41	6	2,216	34
St. Helena	2	4,608	61	2	4,499	59
St. James	5	3,170	53	5	3,070	50
St John the Baptist	5	2,963	51	5	2,968	48

TABLE I.—NUMBER OF DOCTORS AND PERSONS PER DOCTOR, BY PARISHES, 1946 AND 1950 (Contined).

Parish	1946			1950		
		Persons per Doctor			Persons per Doctor	
	No. of Doctors	Ratio	Rank	No. of Doctors	Ratio	Rank
St. Landry	30	2,520	42	30	2,612	43
St. Martin	9	2,938	50	8	3,314	54
St. Mary	13	2,620	43	16	2,238	36
St. Tammany	18	1,421	11	20	1,344	9
Tangipahoa	28	1,787	19	33	1,608	15
Tensas	4	3,567	55	5	2,630	44
Terrebonne	15	2,682	45	18	2,396	40
Union	11	1,803	20	10	1,909	26*
Vermilion	16	2,326	36	17	2,169	32
Vernon	13	1,464	14	9	2,106	31*
Washington	20	1,837	23	21	1,822	20
Webster	23	1,515	15	19	1,875	22
W Baton Rouge	2	5,721	64	3	3,854	57
W. Carroll	5	3,585	56	6	2,840	46
W. Feliciana	4	2,728	47	2	5,021	60
Winn	6	2,737	48	5	3,217	53
LOUISIANA	2,406	1,058	..	2,709	985	..

Source: Louisiana State Board of Medical Examiners, *Official List, Physicians, Surgeons, Midwives, Chiropodists* (1946 and 1950).

*Bienville and Union parishes have the same ratio and rank 26th. Avoyelles and Vernon parishes rank 31st jointly.

many as 2,500 residents, were characterized by a person-per-doctor ratio of 2,549 in 1950. Contrast this to the situation in the eight parishes having more than 40 per cent urban population in 1940.[6] In these parishes, the ratio of persons per doctor was only 596 in 1950. Assuming that parish lines are not crossed by those persons seeking medical attention, a doctor practicing in one of the rural parishes would have to care for, on an average, almost five times as many people as a physician located in the eight more urban parishes.

In considering the individual rural parishes, one finds considerable variations. Several parishes reported persons-per-doctor ratios in excess of 4,000. These include St. Bernard (11,089), Catahoula (5,869), West Feliciana (5,021), St. Helena (4,499), and East Carroll (4,074). Of this group, only East Carroll had any urban population in 1940. A doctor practicing in these parishes has approximately ten times as many potential patients as a doctor working in the state's eight most urban parishes. In St. Bernard parish, with a population of over 11,000 persons, there is only one doctor.[7] La Salle parish, on the other hand, had the relatively low ratio of 1,154.

---

[6] Orleans, Washington, Lafayette, Iberia, Calcasieu, Caddo, Rapides, and Ouachita.

The remaining parishes (those in which urban people, though present, comprised less than 40 per cent of the total population in 1940) had an average persons-per-doctor ratio of 1,764 in 1950.[8] They are in an intermediate position between the most urban and the totally rural parishes. The persons-per-doctor ratios in these parishes fall considerably short of the standard of 1,000 to 1 as established by the United States Public Health Service for adequate health care. Physicians practicing in these areas are, on the average, accessible in their respective parishes to more than three times as many people as the doctors in the eight most urban parishes. Within this group of parishes variations are also evident. East Baton Rouge had the very low persons-per-doctor ratio of 855 in 1950. However, it was only because of technicalities involving the city limits of Baton Rouge that the parish was included as having less than 40 per cent urban population in 1940. Actually, East Baton Rouge parish is one of the more urban parishes in the state. Parishes with comparatively high ratios of persons per doctor (2,000 or more) were Avoyelles, Beauregard, Bossier, Concordia, De Soto, East Carroll, Evangeline, Jefferson, Madison, Morehouse, Natchitoches, St. Landry, St. Martin, St. Mary, Terrebonne, Vernon, Vermilion, and Winn (See Table I).

These data clearly indicate that there is a distinct inverse relationship between urbanization and numbers of persons per doctor. The lowest ratios are found in the more urban parishes and the highest ratios in the more rural ones. The parishes having some urban population but less than 40 per cent hold an intermediate position.

It is obvious that a mere statement of the ratio of persons per doctor does not tell the whole story of the availability of medical personnel to rural people. The distance factor is one which must be taken into consideration. Not only are rural practitioners too few, but they are often distributed in such a manner as to be relatively inaccessible to certain rural areas. In order to reveal the extent of accessibility of physicians to rural people of Louisiana, Figure 1 has been prepared. An analysis of this figure indicates that the distance factor is a serious handicap for rural people in securing the services of a doctor in many parts of the state. The population in the southern parts of Cameron, Vermilion, Terrebonne, Lafourche, Plaquemines, and St. Bernard parishes must travel ten miles or more in order to obtain professional medical attention. The same situation exists in large parts of Beauregard,

---

[7] The bulk of the residents of St. Bernard Parish, it should be noted, are readily accessible to medical personnel in New Orleans.

[8] Acadia, Allen, Ascension, Avoyelles, Beauregard, Bossier, Claiborne, Concordia, De Soto, East Baton Rouge, East Carroll, East Feliciana, Evangeline, Franklin, Iberville, Jackson, Jefferson, Jefferson Davis, Lafourche, Lincoln, Madison, Morehouse, Natchitoches, St. Landry, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermilion, Vernon, Webster and Winn parishes.

Vernon, Rapides, Natchitoches, Jackson, Ouachita, Winn, LaSalle, Catahoula, Concordia, Tensas, and Madison parishes. The few people living in the Atchafalaya basin in Iberia, St. Martin, and Iberville parishes also do not have ready access to the services of a physician. A similar situation prevails in scattered areas elsewhere throughout the state.

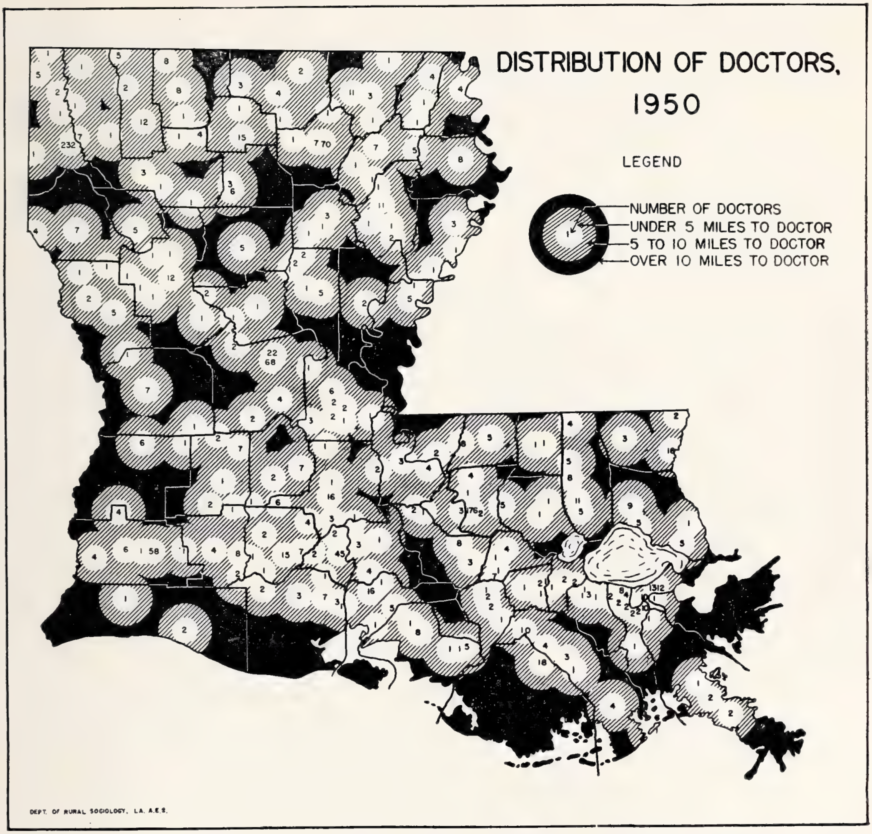


FIGURE 1.—DISTRIBUTION OF DOCTORS, 1950. SOURCE: LOUISIANA STATE BOARD OF MEDICAL EXAMINERS, *Official List Physicians, Surgeons, Midwives, Chiropodists,* 1950.

The Availability of Dentists

In 1948, there were 976 dentists in Louisiana who were certified by the State Board of Dentistry. The ratio of persons per dentist for the state was 2,667. The ratio in 1946 was 3,738. In comparing these figures with the standard established by the Committee on the Cost of Medical Care, an extremely large deficiency in the state is evident. The Committee estimated the optimal ratio to be between one dentist per 556 persons and one per 1,000 persons, depending upon the backlog of dental defects to be corrected.[9] The ratio of persons per dentist for Louisiana in 1948 was almost three times greater than this estimated minimum for optimal dental care. The 976 dentists who were attempting to care for the dental needs of more than two and one-half million Louisianians obviously were numerically insufficient to cope successfully with the task.

The most favorable situations, as far as the number of persons per dentist was concerned, were found in Orleans parish (1,414) and Caddo parish (1,952). No other parish had a persons-per-dentist ratio of less than 2,000 in 1948. Even in these parishes, the number of dental personnel relative to population is far above the 1,000 to 1 minimum for optimal dental care. Table II presents the distribution of dentists by parishes for 1946 and 1948. An analysis of these data indicates that, in general, the same relationship previously pointed out between the degree of urbanization and the availability of physicians is also true for dentists. The more urban parishes had lower ratios than the more rural ones. Both parishes named above as having a persons-per-dentist ratio of less than 2,000 contain large urban centers. On the other hand, three rural parishes did not have a single dentist. The residents of St. Bernard, Plaquemines, and St. Helena parishes in 1948 were obliged either to do without dental care or to incur considerable expense and inconvenience in traveling to a city in some other parish in order to secure it. Besides these situations, in each of five parishes, there was one dentist for the entire population. Assuming dental care is obtained only within a parish, one finds that in West Feliciana parish, one dentist was responsible for the dental health of 10,378 persons; in Red River parish, one for 12,850 persons; in Grant parish, one for 14,561 persons; in Livingston parish, one for 19,397 persons; and in Sabine parish, one for 21,388 persons.

The 23 totally rural parishes taken collectively had a ratio of persons per dentist of 5,768 in 1948. Compare this with the parishes having more than 40 per cent urban population. In the latter group, there were 1,789 persons per dentist, which simply means that, assuming parish lines are not crossed, a dentist working in the rural parishes would have about five times as many potential patients as a dentist in the more urban parishes. The intermediate group of parishes, those with some urban population but less than 40 per cent, had a persons-per-dentist ratio of 3,824. A dentist in these parishes would be responsible for the dental health of three times as many people as a dentist in the more urban parishes. These data indicate that there is a significant relationship between urbanization and the availability of dentists—the more urban the parish, the lower the persons-per-dentist ratio and vice versa.

As in the case of doctors, persons-per-dentist ratios by themselves do not give a complete picture of the availability of dentists to rural people.

---

[9] Frederick D. Mott and Milton I. Roemer, *Rural Health and Medical Care* (New York: McGraw-Hill Book Company, Inc., 1948), p. 186.

TABLE II.—NUMBER OF DENTISTS AND PERSONS PER DENTIST, BY PARISHES, 1946 AND 1948.

Parish	1946			1948		
	No. of Dentists	Persons per Dentist		No. of Dentists	Persons per Dentist	
		Ratio	Rank		Ratio	Rank
Acadia	12	3,895	12	10	4,687	38
Allen	3	6,089	41	4	4,628	37
Ascension	5	4,368	21	5	4,422	33
Assumption	5	3,552	7	6	2,917	10
Avoyelles	12	3,204	4	14	2,727	7
Beauregard	3	5,522	37	3	5,713	46
Bienville	4	5,257	31	5	4,011	24
Bossier	4	8,860	49	7	5,171	43
Caddo	69	2,390	2	87	1,952	2
Calcasieu	20	3,815	10	30	2,763	8
Caldwell	2	5,473	35	3	3,526	19
Cameron	0	. . .*	61	1	6,429	50
Catahoula	1	12,890	55	3	4,105	26
Claiborne	7	3,854	11	10	2,602	6
Concordia	2	7,217	44	3	4,797	40
De Soto	5	5,493	36	7	3,717	21
E. Baton Rouge	32	4,039	15	69	2,071	3
E. Carroll	2	8,693	48	2	8,421	54
E. Feliciana	1	18,668	59	3	6,292	49
Evangeline	6	5,224	29	7	4,512	35
Franklin	3	10,188	52	4	7,498	52
Grant	2	7,452	46	1	14,561	59
Iberia	15	2,603	3	14	2,833	9
Iberville	6	4,513	23	6	4,477	34
Jackson	2	8,186	47	2	7,946	53
Jefferson	6	13,631	57	9	10,249	56
Jefferson Davis	4	6,373	43	8	3,241	15
Lafayette	9	5,750	39	23	2,363	4
Lafourche	9	4,496	22	13	3,160	12
La Salle	3	4,000	13	3	4,109	27
Lincoln	6	4,195	18	6	4,217	29
Livingston	1	18,995	60	1	19,397	60
Madison	2	8,922	50	2	8,822	55
Morehouse	6	5,044	28	6	5,194	44
Natchitoches	7	5,578	38	9	4,266	30
Orleans	245	2,197	1	391	1,414	1
Ouachita	17	4,014	14	29	2,457	5
Plaquemines	0	. . .*	64	0	. . .*	64
Pointe Coupee	6	3,782	8	6	3,710	20
Rapides	24	3,476	6	29	2,992	11
Red River	1	13,608	56	1	12,850	58
Richland	6	4,587	24	7	3,870	22
Sabine	3	7,313	45	1	21,388	61
St. Bernard	0	. . .*	63	0	. . .*	63
St. Charles	3	4,302	20	3	4,367	31
St. Helena	0	. . .*	62	0	. . .*	62
St. James	3	5,283	32	4	3,900	23
St. John the Baptist	3	4,938	26	3	4,942	42

TABLE II.—Number of Dentists and Persons per Dentist, by Parishes, 1946 and 1948 (Continued).

Parish	1946			1948		
	No. of Dentists	Persons per Dentist		No. of Dentists	Persons per Dentist	
		Ratio	Rank		Ratio	Rank
St. Landry	14	5,401	34	16	4,812	41
St. Martin	5	5,288	33	5	5,291	45
St. Mary	9	3,785	9	11	3,176	13
St. Tammany	6	4,263	19	6	4,372	32
Tangipahoa	12	4,170	17	15	3,436	17
Tensas	1	14,267	58	3	4,570	36
Terrebonne	12	3,353	5	12	3,473	18
Union	2	9,916	51	3	6,487	51
Vermilion	6	6,203	42	11	3,367	16
Vernon	4	4,758	25	4	4,748	39
Washington	7	5,248	30	9	4,167	28
Webster	7	4,978	27	11	3,203	14
W. Baton Rouge	1	11,442	54	2	5,751	47
W. Carroll	3	5,975	40	3	5,828	48
W. Feliciana	1	10,713	53	1	10,378	57
Winn	4	4,105	16	4	4,063	25
LOUISIANA	681	3,738	..	976	2,670	..

Source: State of Louisiana, Department of Health, *Quarterly Bulletin*, "The American Academy of Pediatrics' Study of Child Health Services in Louisiana," Vol. XXXIX, No. 3, pp. 49-51. Louisiana State Board of Dentistry, *Official List, Dentists* (1948).

*In 1946, the parishes of Cameron (estimated population 6,622), Plaquemines (estimated population 13,462), St. Bernard (estimated population 9,565), and St. Helena (estimated population 9,215) had no dentists. In 1948, only Plaquemines (estimated population 13,844), St. Bernard (estimated population 10,327), and St. Helena (estimated population 9,106) had no dentists.

The great majority of the dentists in a parish may be concentrated in an urban center, with the result that the rural areas not immediately adjacent to this center are seriously handicapped. In order to allow for an analysis of the spatial availability of dentists to rural people, Figure 2 has been prepared. A study of this chart indicates that many areas of the state do not have the services of a dentist, and that the people living in these sections must travel considerable distances to secure the dental care which they need. The residents of the parishes fronting on the Gulf of Mexico are nearly all at a disadvantage in this respect. Especially is this true of St. Bernard parish, Plaquemines parish, Terrebonne parish, and Cameron parish. Although the population density in these parishes is not great, the people, nevertheless, are for all practical purposes without the services of a dentist. The Atchafalaya basin in St. Martin and Iberville parishes is lacking in dental personnel. The majority of the inhabitants of St. Helena and Livingston parishes have to travel more than ten miles in order to receive dental treatment. The southern parts of Concordia and Catahoula parishes and the northern section of La Salle parish are relatively isolated from the services of dental personnel. Large segments of Beauregard, Vernon, Natchitoches, Rapides, Grant, Winn, and Sabine parishes are in a similar situation. In the northern part of the state, the people of Union parish have a considerable distance to travel in order to avail themselves of the services of a dentist. A like circumstance prevails in much of Morehouse parish. Other sections in which the people do not have ready access to dental personnel are scattered throughout the state.

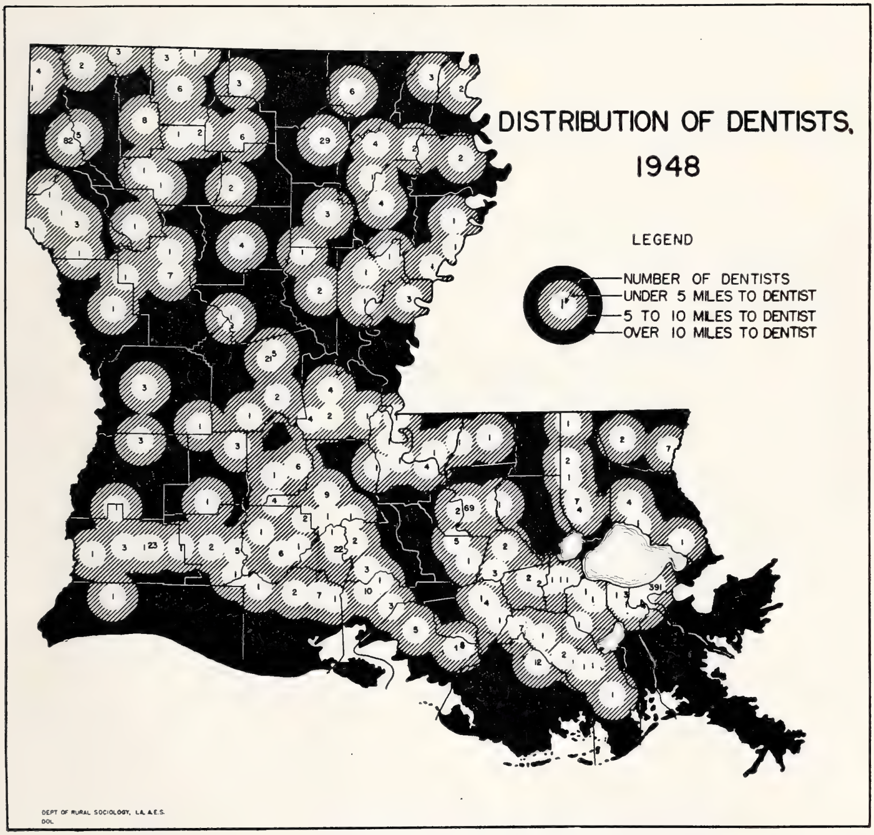


FIGURE 2.—Distribution of Dentists, 1948. Source: Louisiana State Board of Dentistry, *Official List, Dentists*, 1948.

The Availability of Registered Nurses

In 1949, there were 6,060 registered nurses located in the state who were certified by the Louisiana State Board of Nurse Examiners. The persons-per-nurse ratio was 435 in 1949, as compared to 513 in 1946. Since no optimal ratio of nurses to population has been established, a standard of this type is not available for comparison.[10] However, in order to make possible some sort of an evaluation of the adequacy or inadequacy of the supply of nurses in Louisiana, the national average of persons per nurse in 1940 has been used as a basis. The persons-per-nurse ratio in Louisiana in 1949 was considerably higher than the national average in 1940. The actual ratios were 435 and 370, respectively. This indicates that Louisiana in 1949 remained considerably below the position of the nation in 1940 as far as the supply of registered nurses is concerned.

The lowest persons-per-nurse ratios follow the same general pattern as that for doctors and dentists. Table III presents the distribution of registered nurses by parishes for 1946 and 1949. The most urban parishes were characterized by the smallest number of persons per registered nurse. Orleans parish had 218 persons per nurse; Caddo parish, 235; Rapides parish, 266; East Baton Rouge parish, 280; and Ouachita parish, 291. No other parish had a persons-per-nurse ratio of less than 300. Parishes showing the largest number of persons per nurse were predominantly rural. In West Feliciana parish, there were 5,105 persons for each nurse; Catahoula parish, 6,013 persons; Red River parish, 6,236 persons; and Cameron parish, 6,332 persons. If parish lines were not crossed and the services of nurses were used to the same extent in all parishes, a nurse in the above parishes would be responsible for the care of twenty-five times as many persons as a nurse in the five parishes recording the lowest number of persons per nurse.

The twenty-three totally rural parishes in the state had a collective persons-per-nurse ratio of 1,438 as compared to a corresponding figure of 259 for the parishes with over 40 per cent urban population. This means that a nurse in the rural parishes would be responsible for the health needs of six times as many persons as a nurse in the more urban parishes, provided, of course, that parish boundaries are not crossed. The intermediate parishes in 1940 (those having some but less than 40 per cent urban population) together had an average of 744 persons per nurse in 1949. Again assuming that parish limits are not crossed, a nurse in these parishes would have three times as many potential patients as one in the more urban parishes. These figures indicate a direct correlation between urbanization and the facility with which the services of a nurse can be obtained—the more urban the parish, the lower the number of persons per nurse.

Figure 3 shows the spatial distribution of registered nurses in Louisiana in 1949. This map clearly indicates that access to the services of a registered nurse varies greatly from one area of the state to another. The distance factor is of extreme importance in many rural sections of

---

[10] "Authorities are not prepared to suggest an optimal ratio of nurses to population at this time, pending the completion of studies involving a determination of total nursing needs and such considerations as the role of the practical nurse." See Frederick D. Mott and Milton I. Roemer, *Rural Health and Medical Care* (New York: McGraw Hill Book Co., Inc., 1948), p. 192.

the state. People living in most of Cameron parish, Terrebonne parish, and St. Bernard parish do not have the services of a nurse readily available to them. The same situation prevails in a considerable portion of St. Helena, Livingston, Vermilion, and Plaquemines parishes. A nurse is not available to the people living in the Atchafalaya basin in St. Martin, Iberville, and Iberia parishes, except by traveling ten miles or more. Persons residing in segments of Beauregard, Vernon, and Natchitoches parishes are in a similar situation. The residents of at least half of Concordia parish have considerable distance to travel in order to avail themselves of the services of a nurse. Parts of Bienville, Jackson, and Winn parishes are also relatively distant from a locality with a registered nurse. Isolated sections in which the same situation prevails can be found in various other areas of the state.

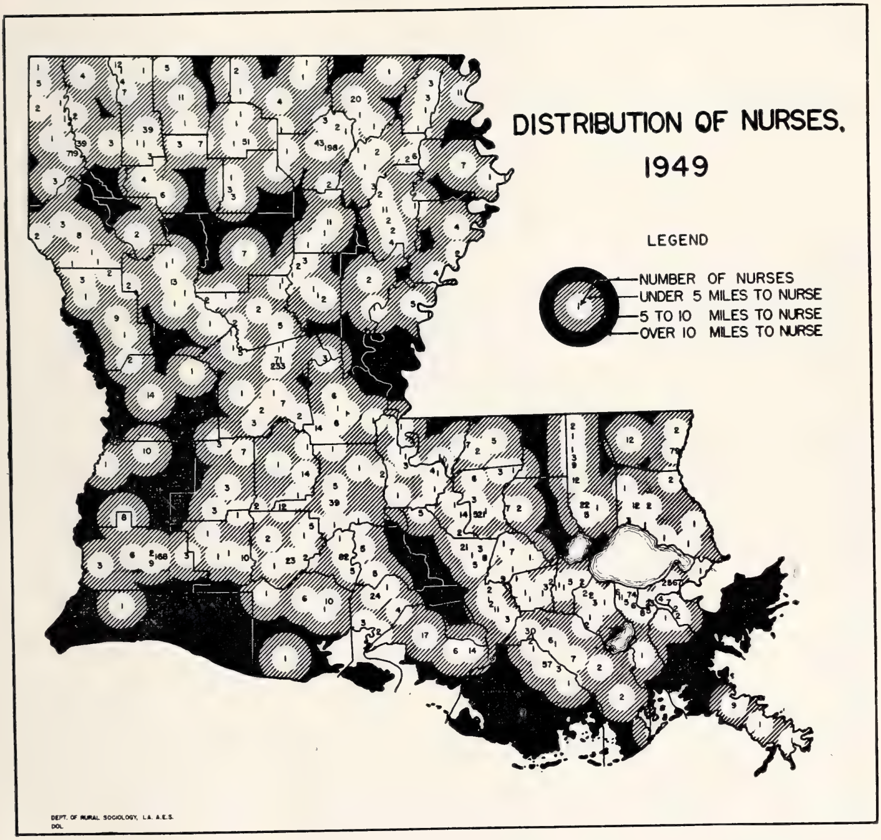


FIGURE 3.—Distribution of Registered Nurses, 1949. Source: Louisiana State Board of Nurse Examiners, *Roster of Registered Nurses*, 1949.

TABLE III.—NUMBER OF REGISTERED NURSES AND PERSONS PER REGISTERED NURSE, BY PARISHES, 1946 AND 1949.

Parish	1946			1949		
	No. of Nurses	Persons per Nurse		No. of Nurses	Persons per Nurse	
		Ratio	Rank		Ratio	Rank
Acadia	26	1,798	48	34	1,380	38
Allen	13	1,405	32	16	1,164	27
Ascension	23	950	17	19	1,170	28*
Assumption	14	1,269	29	19	914	19
Avoyelles	24	1,602	39	29	1,312	32
Beauregard	12	1,381	30	11	1,584	43
Bienville	12	1,752	46	20	979	22
Bossier	47	754	11	48	762	16
Caddo	619	266	2	733	235	2
Calcasieu	138	553	7	199	433	7
Caldwell	14	782	12	13	800	17
Cameron	1	6,622	62	1	6,332	61
Catahoula	3	4,297	59	2	6,013	59
Claiborne	17	1,587	37	18	1,419	39
Concordia	10	1,443	33	7	2,053	53
De Soto	16	1,717	43	16	1,581	42
E. Baton Rouge	386	335	5	535	280	4
E. Carroll	4	4,347	60	11	1,506	41
E. Feliciana	12	1,556	36	14	1,356	36
Evangeline	9	3,482	58	19	1,670	44
Franklin	18	1,698	42	22	1,350	35
Grant	9	1,656	41	14	1,028	23
Iberia	28	1,394	31	34	1,176	29
Iberville	26	1,041	21	43	622	10
Jackson	13	1,259	28	8	1,957	52
Jefferson	90	909	15	140	696	14
Jefferson Davis	21	1,214	27	14	1,867	48
Lafayette	72	719	10	88	632	11
Lafourche	42	964	19	48	862	18
La Salle	5	2,400	54	12	1,043	24
Lincoln	32	787	13	54	470	8
Livingston	10	1,900	49	9	2,178	55
Madison	8	2,231	53	9	1,949	51*
Morehouse	19	1,593	38	23	1,374	37
Natchitoches	22	1,775	47	20	1,903	49
Orleans	2,124	253	1	2,568	218	1
Ouachita	216	316	3	250	291	5
Plaquemines	9	1,496	34	12	1,170	28*
Pointe Coupee	14	1,621	40	12	1,837	47
Rapides	240	348	6	332	266	3
Red River	9	1,512	35	2	6,236	60
Richland	11	2,502	55	15	1,791	46
Sabine	21	1,045	22	16	1,320	33
St. Bernard	10	957	18	15	714	15
St. Charles	13	993	20	11	1,200	30
St. Helena	0	...†	64	0	...†	62
St. James	14	1,132	24	9	1,719	45
St. John the Baptist	7	2,116	51	10	1,483	40

TABLE III.—NUMBER OF REGISTERED NURSES AND PERSONS PER REGISTERED NURSE, BY PARISHES, 1946 AND 1949 (Continued).

Parish	1946			1949		
	No. of Nurses	Persons per Nurse		No. of Nurses	Persons per Nurse	
		Ratio	Rank		Ratio	Rank
St. Landry	44	1,718	44	62	1,253	31
St. Martin	10	2,644	56	10	2,647	57
St. Mary	41	831	14	87	956	21
St. Tammany	22	1,163	25	24	1,107	25
Tangipahoa	55	910	16	57	918	20
Tensas	12	1,189	26	10	1,343	34
Terrebonne	37	1,087	23	64	663	12
Union	10	1,983	50	10	1,927	50
Vermilion	17	2,189	52	19	1,949	51*
Vernon	11	1,730	45	17	1,116	26
Washington	112	328	4	93	407	6
Webster	60	581	8	69	513	9
W. Baton Rouge	18	636	9	17	678	13
W. Carroll	3	5,975	61	8	2,158	54
W. Feliciana	4	2,678	57	2	5,105	58
Winn	1	16,420	63	7	2,310	56
LOUISIANA	4,960	513	..	6,060	435	..

Source: Louisiana State Board of Nurse Examiners, *Roster of Registered Nurses*, 1949 (mimeographed) and 1946.

*Ascension and Plaquemines parishes have the same ratio and rank 28th. Madison and Vermilion rank 51st jointly.

†St. Helena Parish had no registered nurses in either 1946 or 1949. The estimated populations of this parish for these years were 9,215 (1946) and 9,051 (1949).

Trends

By comparing the persons-per-doctor, -nurse, and -dentist ratios of 1946 with those of the present, it is possible to determine the trends that are developing as far as the availability of medical personnel is concerned. (See figure on cover.) The total figures for the state show that decreases in the number of persons per doctor, per dentist, and per nurse were achieved during this period. This change indicates that, from the over-all standpoint, the state has made progress with respect to the number of medical personnel serving its people. However, there is little evidence that the differential that exists between the rural and urban parishes is being eliminated or even narrowed. Classifying the parishes according to the degree of urbanization, one finds that the rural areas have not improved their relative position (Table IV). In fact, the greatest reduction in population-medical personnel ratios has taken place in the more urban parishes. The totally rural parishes, although improving their situation, recorded the smallest decreases in

TABLE IV.—CHANGES IN PERSONS-PER-DOCTOR, -PER-DENTIST, AND -PER-REGISTERED NURSE RATIOS, CLASSIFIED ACCORDING TO DEGREE OF URBANITY OF THE PARISHES, 1946 AND 1950.

Parishes According to Urbanity, 1940	Persons per Doctor		Per Cent Change	Persons per Dentist		Per Cent Change	Persons per Nurse		Per Cent Change
	1946	1950		1946	1948*		1946	1949*	
With 40 per cent or more urban population	640	596	− 6.9	2,607	1,789	−31.4	298	259	−13.1
With from 1 to 39 per cent urban population	1,842	1,764	− 4.2	5,073	3,838	−24.4	957	774	−19.1
With no urban population	2,619	2,549	− 2.7	6,880	5,768	−16.2	1,574	1,438	− 8.6
LOUISIANA	1,058	985	− 6.9	3,738	2,670	−28.6	513	435	−15.2

Source: Louisiana State Board of Medical Examiners, *Official List, Physicians, Surgeons, Midwives, Chiropodists, 1946 and 1949.* Louisiana State Board of Dentistry, *Official List, Dentists, 1948.* State of Louisiana Department of Health, *Quarterly Bulletin*, Vol. XXXIX, No. 3, pp. 49-51. Louisiana State Board of Nurse Examiners, *Roster of Registered Nurses*, 1946 and 1949 (mimeographed).

*1950 data are not available for dentists and nurses.

the number of persons per doctor, per dentist, and per nurse. The other group of parishes (those with some but less than 40 per cent urban population) again held an intermediate position. Improvement made in these parishes, as a whole, was less than that in the more urban parishes, but greater than the change occurring in the totally rural group.

The greatest percentage decreases in population-medical personnel ratios have been made in regard to dentists. The number of persons per dentist in the state showed a decrease of 28.6 per cent between 1946 and 1948. In the more urban parishes the decrease was 31.4 per cent as compared to 16.2 per cent for the totally rural parishes. For the state, the persons per registered nurse decreased by 15.2 per cent between 1946 and 1949. The intermediate parishes showed the greatest decrease (19.1 per cent) and the totally rural parishes recorded the smallest (8.6 per cent). The smallest decrease for the state was in regard to doctors. The number of persons per doctor showed a decrease of only 6.9 per cent between 1946 and 1950. In the totally rural parishes, the decrease was only 2.7 per cent as compared to 6.9 per cent in the more urban parishes.

The above data support the contention that rural areas continue at a relative disadvantage in regard to the availability of medical personnel and that their relative position is not being improved with the passing of time. It should be pointed out that this is not a unique situation, but one that has been observed throughout the nation. Mott and Roemer state that "as early as 1906, when about 56 per cent of the nation's population was regarded as rural, there was a clear disproportion, for only 41 per cent of the available physicians were in rural practice. By 1940, when the nation's rural population had declined relatively by less than one-fourth to 43.5 per cent, the physicians in rural practice fell to about 20 per cent of the nation's total, or half their former proportion."[11] Louisiana, as evidenced by the data presented above, appears to be conforming to this general trend.

Summary and Conclusions

1. In 1940, Louisiana held an unenviable position regarding the ratios of persons per doctor, per dentist, and per nurse when compared to other states of the nation. The state ranked 31st in the number of persons per doctor, 35th in the number of persons per dentist, and 37th in the number of persons per nurse.

2. In 1949, there were 2,687 certified doctors in Louisiana, and the persons-per-doctor ratio was 985. The state, as a whole, therefore, met the general standard for adequate physician supply of 1 to 1,000 as proposed by the United States Public Health Service.

---

[11] Mott and Roemer, *op. cit.*, p. 163.

3. In 1948, there were 976 certified dentists in Louisiana. The ratio of persons per dentist was 2,670. The state thus falls far below the standard for optimal dental care as established by the Committee on the Costs of Medical Care. The Committee estimated the optimal ratio to be between one dentist per 556 and one per 1,000 persons, depending upon the backlog of dental defects to be corrected. Therefore, it appears that the supply of dentists in Louisiana is extremely deficient.

4. In 1949, there were 6,060 registered nurses located in Louisiana. The persons-per-nurse ratio was 435. No optimum ratio of persons per nurse has been established; however, the ratio for the nation in 1940 was 370. Louisiana, therefore, still had not attained, in 1949, the persons-per-nurse ratio for the nation in 1940.

5. An analysis of the distribution of doctors, dentists, and nurses by parishes indicates significant differentials. Some parishes have very low persons-per-doctor, -per-dentist, and -per-nurse ratios, while others have very high ratios. In general, the more urban parishes have the smallest number of persons per doctor, dentist, and nurse and the rural parishes have the greatest number.

6. By dividing the state into three groups of parishes classified according to the degree of urbanization, it is possible to make comparisons concerning the relative availability of medical personnel to rural people. The three groups of parishes are as follows: (1) the parishes which were totally rural in 1940, (2) the parishes which had some but less than 40 per cent urban population in 1940, and (3) the parishes which had more than 40 per cent urban population in 1940. In all cases, the more urban parishes showed the lowest ratios of persons per doctor, dentist, and nurse; the intermediate parishes had much higher ratios; and the totally rural parishes recorded the highest ratios. This suggests a direct correlation between urbanization and the facility with which people can obtain the services of doctors, dentists, and nurses.

7. An examination of the spatial distribution of doctors, dentists, and nurses (Figures 1, 2, and 3) shows a strikingly similar pattern. Areas lacking in doctors are also lacking in dentists and nurses. Most sections lacking medical personnel are rural in character.

8. Dentists are less readily available to rural people than doctors and registered nurses. Large segments of rural Louisiana are without the services of a dentist. The same is true of doctors and nurses, but to a lesser degree.

9. A study of trends between 1946 and the present reveals that the relative position of the rural parishes has not been improved during that period. Although reductions in the number of persons per doctor, dentist, and nurse occurred in all groups of parishes analyzed, the decrease was greatest in the more urban parishes and smallest in the totally rural parishes.

LSU Libraries
3 1518 097 539 807

BOUND BY
HNM